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ABSTRACT

Presented is a developmental concept of perceptual processing as related to learning disabilities in young children. Learning is seen to involve the interaction of cognitive developmental stages at the preverbal, verbal, and postverbal levels with learning disabilities seen to be due to perceptual handicaps. A model is offered which posits a hierarchy of learning capacities resulting from increasing differentiation of the nervous system and the importance of modality preference in matching instruction to the child. A perceptual test battery is described. Confirmation of the author's theories is seen in results of five field studies which investigated the development of perceptual processing, the modality distinction, and the reliability and validity of the test battery. Stressed is the importance of matching instruction to the child's individual learning style. The ignoring of individual differences in the development of perceptual adequacy is seen to be responsible for many learning disabilities. A chapter (reprinted from Issues on Classification of Children by N. Hobbs) focuses on the purposes of classification, evaluation and intervention with learning disabilities. Three detailed case histories are provided to illustrate the type of examination, diagnosis, and recommendations that can be made in evaluating a child's problem. Educational implications of the author's model are seen to involve early perceptual training and modality oriented instruction. (DB)

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SECTION I

PERCEPTUAL PROCESSING DEVELOPMENT:
Its Relation to Learning and learning disabilities

by

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November 30, 1974

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> "....the most effective learning takes place when the interactive process (teaching) is one that is best suited to the individual student in terms of his learning style. A learning environment that is optimal for one person is not optimal for another. The educational environment must be matched with the individual. Adaptation to the individual has never been systematic because no one has known the principles that govern the matching of learner and educational environment." (Cronbach & Snow, 1969)

Chapter I - Perspectives and Assumptions

The role of perceptual processing abilities in the development of cognition as viewed in the present monograph follows rather closely the cognitive developmental concept espoused by Piaget and his interpretors (1960). Perceptual processing is seen as operationally defining sensori-motor learning within a hierarchy of interlocking stages. The first stage beginning with the reflex potential at birth which establishes the intactness of the physiological structure for learning, i.e., the prodromal and largely undifferentiated central nervous system. The second stage, perceptual or sensori-motor and preoperational level coming into being shortly after birth as the CNS becomes more differentiated and capable of beginning to make discriminations and selections from incoming sensory stimuli and imitating them as outgoing motor acts. This level is seen to develop at differential rates in children along sensory-modality bound lines, i.e., visual, auditory, kinesthetic, tactile, etc. It is developmental in the sense that as children grow older (largely through the first eight years of life) they become more and more competent to function within each modality.

The basic form of which the perceptual processes consist are pre-verbal in nature. The changes in ability are believed to be directly related to the increasing differentiation of the CNS. As the CNS develops a greater capacity for more complex behavior the child becomes more competent in his imitativeness. He learns to monitor his own production as he reaches a stage in perceptual development, that is one of adequacy of performance permitting the development of the next stage, that of concrete operations.

It is as he reaches and passes the threshold of adequacy that his learning ability turns from the purely imitative to the more integrative synthesis of conceptual thought. Of primary importance is the differential rate of development of modalities.

Piaget notes, for example, that "the acquisition of language presupposes the prior information of sensory motor intelligence." (1971)

It is at the perceptual level which operates on an unconscious or subconscious basis that the child acquires his alphabets of sounds for speech and letters for reading, writing and spelling. With the acquisition over time of these alphabets the higher conscious levels gain the form and structure necessary for linguistic expression.

Language formulated prior to the development of an adequate level of perceptual development takes the form of inaccurate articulation (according to societal standards) in speech or oral reading. Silent reading beyond the level of recognition where comprehension is expected also suffers by the inadequacy of phonic integration.

As a working model three stages of learning are postulated (1) the preverbal stage (roughly for most unimpaired children the first five years of life as new capacities become available through the rapidly changing nervous system); (2) the learning-to-learn stage (roughly the 5 through 8 year age level) wherein the child learns his idiosyncratic adaptation to the tasks presented such as increasing vocabulary constraints in speech, reading, writing and spelling forms of language; and (3) the abstract learning stage where children apply the approach to learning developed during the earlier stage (roughly at or by the end of the eighth year).

The present paper is devoted to an explication of stage two--the learning-to-learn stage where perceptual processes reach their culmination and provide the base and structure for verbal formulation necessary for the full development of later developing conceptual processes.

At this stage the predilection for one modality over another can and should be determined. Since the modalities are known to develop at differential rates--auditory more rapidly than visual or kinesthetic more rapidly than auditory, etc., it is assumed that the child's preferential modality will be the one that has developed best or, stated otherwise, the modality of choice in learning-to-learn would follow the child's inclination or developmental pattern. Thus, in over-simplified terms, if a child shows early and rapid development of his auditory perceptual ability, he is likely to be most comfortable with a phonic (auditory) approach to reading. If his visual modality shows a more rapid development, that is, reaches the level of adequacy sooner than the auditory, a visual sight training approach to reading might well be indicated. Methods in intervention--the educational endeavor--should then follow the child's predilection, assisting and supporting his preference.

It is a further assumption within this schema that the child's preferential modality for learning is innate--modified by experience most easily when this innate process is matched by the methods used in initial instruction.

Both stage one and stage two fall within the developmental age period often identified as 'critical periods' for learning. The concept of stages implies an invariant order of sequence of development. Cultural and environmental factors or innate capabilities may make one child or group of children reach a given stage of development at a much earlier point of time than other children. All children, however, should still go through the same order of stages, regardless of environmental intervention (teaching) or lack of teaching.

The interrelatedness of the stages of development is seen in the subconsciously learned sensory-motor abilities becoming the base for the expression of verbal formulations occurring at the higher level hierarchical development of concrete thought operations. These then become elaborated by giving rise to distinct lines of behavior at the still higher mental process of abstract thought. Learning-to-learn, stage two in the model, is the critical period when the child is developing his own attack on tasks at the concrete level of thought.

Learning disabilities arise at later stages of learning when concrete thought needs to generalize to abstract thought; when vicarious competence is necessary rather than specific experience. Learning disabilities should be differentiated from learning problems. The true learning disability may be produced by faulty instructional timing--as in educational efforts before the development of adequacy in perceptual processing or as the result of a mismatch at stage two between method and competence within the modality of instruction.

One fairly common type of learning disability is seen, for example, in the child who has failed to reach the necessary threshold of adequacy in perceptual processing when he is asked to perform conceptual tasks dependent upon the perceptual processes involved. Within this framework the child with a learning disability is one with a specific perceptual handicap regardless of the etiology of the handicapping condition.

In some children the perceptual handicap may arise simply from a developmental lag within a vital perceptual process; i.e., for example, the introduction of phonic instruction in reading before a child has reached his threshold of adequacy in auditory discrimination, auditory memory and/or auditory sequential ability. It would be assumed that a delay in development of all three of the identified auditory perceptual processes would be a more significant barrier to phonic instruction than a lag in the development in any one of the processes.

In other children the learning disability--the specific perceptual handicap--may be the result of brain impairment rather than a developmental lag. The etiology, however, is of little importance to the educator--the incapacity itself of major importance.

One factor of prime importance should be understood at the outset, this is the differentiation between learning disabilities which are looked upon as due to specific perceptual imperceptions and learning problems. The latter are those primary emotional, severe generalized and debilitating socio-economic conditions which often serve to block educational advancement. Within the present schema the etiology of the problems as diagnosed determines the type of intervention that should be employed; i.e., psychotherapy for emotional problems, etc. These conditions, however, are not seen as learning disabilities or should not be considered as children in need of educational intervention even if they show perceptual handicaps until the primary problem has been resolved.

SUMMARY

Three stages of development are discussed in a cognitive-developmental framework--preverbal, verbal and post-verbal. Learning is postulated as the interaction of a hierarchy of developmental stages. Each stage building on the previous stage. Learning disabilities are defined within this model as those conditions of perceptual inadequacies which block a child from gaining the necessary competence to apply his own approach to learning at the higher cognition. This is demonstrated in the school age child who has difficulty in acquiring adequate ability in reading, writing, spelling and computation.

Learning disabilities are defined as being due to perceptual handicaps and are differentiated from learning problems caused by primary emotional disturbances, generalized intellectual maldevelopment or poor socio-economic conditions.

Chapter II - The Perceptual Conceptual Modality Model

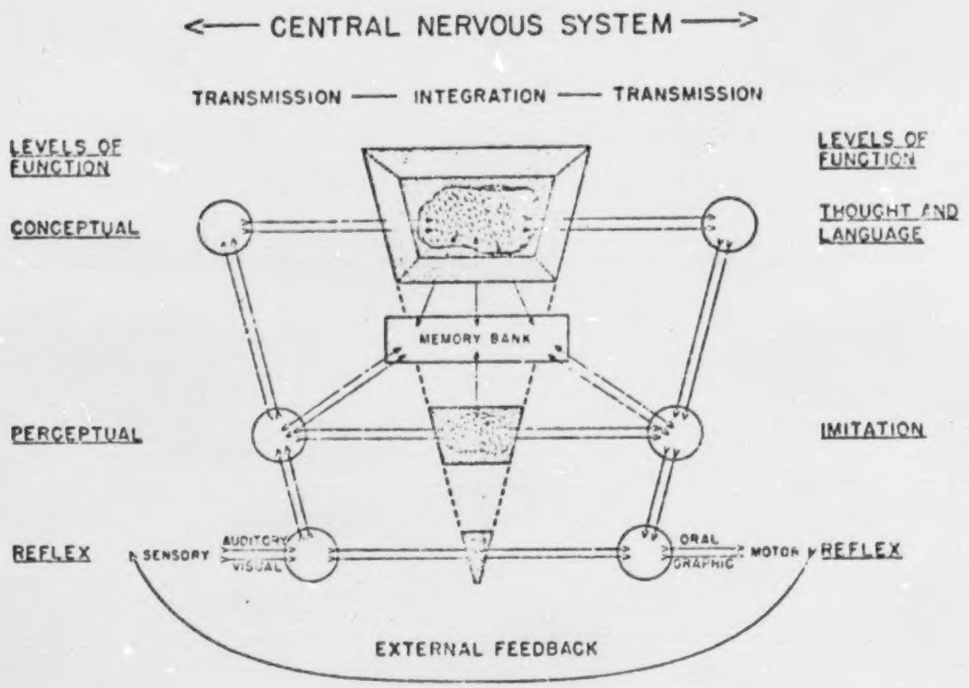
A theoretical model of the developmental processes which enable a child to learn and use language was developed early in the 1960's (Osgood & Miron, 1963). The model presented graphically three stages of learning behavior corresponding to the increasing differentiation of the central nervous system.

The model has many points in common with those expressed by Piaget (1969) and others of the developmental school. It illustrates the stages of development corresponding to neurological differentiation, new levels of behavior becoming observable as the child develops the capacity to utilize his nervous system in more and more complex ways.

Figure 1 goes here

The first level was described as that of reflexive behavior present for the most part at or shortly after birth. The reflexes are prime examples of modality bound behavior following specific input and specific output pathways. As the level indicates by its label--reflex--the behavior is invariate--a given sensory signal evoking a specific motor response. Integration at this level is minimal consisting essentially of a translation from sensory to motor behavior. Nothing new is learned at this level--the responses indicating merely that the nervous system is intact and capable of fulfilling the reflex act.

Figure 1.


CENTRAL NERVOUS SYSTEM
TRANSMISSION — INTEGRATION — TRANSMISSION
LEVELS OF FUNCTION
CONCEPTUAL
PERCEPTUAL
REFLEX
SENSORY
AUDITORY
VISUAL
MEMORY BANK
LEVELS OF FUNCTION
THOUGHT AND LANGUAGE
IMITATION
ORAL
GRAPHIC
MOTOR
REFLEX
EXTERNAL FEEDBACK

AN OPERATIONAL DIAGRAM OF THE LEVELS OF FUNCTION IN THE CNS

The absence of a reflex or its over-reaction upon stimulation are indicators of impairment of the nervous system. The reflex behaviors are essential to life. They function automatically and while no learning is involved in their functioning, they present evidence for the intactness of the system. Such behaviors as sucking, grasping, and breathing are examples of reflexive behavior entailing relatively complex motor movements which later are built into learned acts such as speech, gesture, etc. in the development of language. It is important to note, however, that the learned acts in language are not dependent on reflex stimulation, but are acquired at a later stage of development.

The model indicates the second level of behavior to be perceptual-motor in nature. Following the Piagetian concept this level includes both sensory-motor and pre-operational behaviors. The two blend into a single level of perceptual-motor functions. This is seen as the level of imitation, of echoic behavior. Neurologically, the development of the brain stem permits the perceptual level of function. Learning in its simplest form goes on at this level--for the most part the learning is subconscious; i.e., goes on through integration of multi-sensory inputs into selected motor outputs. Each sensory stimulation results in imprinting on the memory bank. Repetition enhances performance at this level. Integration at this level includes not only association with past related learning but through feedback and the development of an internalized monitoring system, of one's own behavior, gauging its success or failure. The monitoring of both internal (proprioceptive) and external (exteroceptive) behavior with the self-correction of errors provides the child with a developing mechanism for improvement of behavior.

As the model indicates all input and output aspects of the perceptual level are modality bound. Thus, auditory stimulation remains just that until in the process of integration with past learning the modality distinction is lost. It again becomes operative in the output or motor aspects where the form of expression is again selective--the response being tailored to the expressive need--oral expression in the case of echoic speech or, hand and arm movements if gestures are needed to fulfill the imitation pattern.

The perceptual processes of immediate concern to learning since they provide the basic structure of the verbal symbols used in all forms of language (speech, reading, writing, spelling) include Auditory [(1) discrimination of the sounds used in speaking, (2) recall (span) of the sounds and, (3) recall of the sequential order of sounds], and Visual [(1) discrimination of forms, (2) recall of forms and, (3) recall of the spatial orientation of forms.] These separable perceptual processes have been shown to develop during the first eight years of life (Turaids, Wepman & Morency, 1972). Only a very rare child will show inadequate development of any of these processes after nine years of age, regardless of intellectual or environmental conditions. In consequence, the perceptual processes are felt to be innate with the time and rate of their development predetermined and unaffected by external conditions or conditioning. The one exception to the completion of development by the ninth year before vicarious verbal symbolic use can become really fluent is that of spatial orientation memory of forms. Studies show that this specific process which is thought to relate to the orientation of self in space and to the important right-left distinction appears to develop more slowly in some children--the developmental process continuing into adolescence.

The modality-bound nature of the perceptual processing abilities has led to a distinction of modality preference in children. Thus, some children show early and more adequate development of auditory perception, while others show a preference for and more adequate development of visual perceptual abilities. This distinction of modality preference may be of great importance to education. Auditory perceptual development indicates when a child is ready for learning through phonics which many educators feel is the essential basis for learning to read. While visual perceptual development is recognized as essential for the orthographic aspects of reading, the preference of a child for one or the other modality is felt to be indicative of the approach to reading which is likely to be most effective for individual children as they learn-to-learn.

It is at the level of perceptual readiness that the child's training or education can turn to the verbal symbolic use of language forms at the higher level of conceptualization. Most children will have developed sufficient adequacy in perception by the time they enter formal schooling. However, some will show a marked preference for one modality over the other. If education is directed into the inadequately developed modality--before the children have reached the stage of adequacy in the modality--a mismatch of method and readiness may occur which may seriously impair the child's learning. Note, for example, if a given child has an inadequate development of auditory perception and the approach to reading is phonic in nature and emphasis, the child may have real difficulty in mastering his own approach to reading. Oppositely, if the method used were a visual-sight training approach and the child shows an inadequate development of his visual perception a mismatch will appear that may have serious consequences as the child attempts to develop his own strategy for reading.

To maximize the child's learning-to-learn ability the approach by educators should stress the capacities and the modality of choice of the individual child. It should be noted that for most children the approach used in teaching whether it be phonic or visual sight training will be of little concern since most children as they approach their early educational efforts can learn by either method. Again, to repeat what has been previously stated, if the child begins to apply his abilities to the task of learning before he has developed sufficient adequacy or if his instruction emphasizes the opposite modality to his preference the seeds of poor learning may well be established. Such children, those who are apparently uable to function adequately because of a lag in development or because of a mismatch between their preference and the method used in their instruction, may often later in life be seen to have a learning disability.

From what is known of children and methods of instruction some twenty-five percent or one-quarter of all children may fall into the category of having learning problems. All of these are not children with perceptual handicaps--the causes of learning problems other than the perceptually handicapped learning disabilities are known to affect a considerable number. Such conditions as severe mental retardation, emotional instability, inadequate life opportunity and a variety of physical handicaps are known to produce learning problems. These children and their problems must be carefully differentiated from the children with perceptual handicaps. Resolution of their problems lies in special education directed at the primary source of their difficulty. The perceptually handicapped, however, must be seen as representing a type of child with a specific learning problem--one which may be reduced if not resolved by very specific training designed to either alleviate their problem or, if that is not possible, compensate for their inadequacies by the use of other approaches more closely associated with their capacities.

The perceptual processes form the basis for learning at the conceptual level--the higher mental processes of cognitive function. At the perceptual level recognition and imitation occur below the level of meaning--at the conceptual level meaningfulness of the stimulus, association to other verbal and non-verbal previously learned concepts, the ability to abstract and to formulate verbal symbols, occurs. The alphabet of sounds and letters learned perceptually form the bases for linguistic structure, for language comprehension and use.

The model presents a schema for consideration of two essential developmental factors. First, that a hierarchy of learning capacities follows and is the consequence of increasing differentiation in the nervous system. Second, that processing the perceptual and conceptual signals of all kinds is modality-bound while integration of the signal and selection of the response is not. In such a model the determination of modality preference auditory over visual or vice versa is an important distinction for educators especially for determining a proper match between method of instruction and aptitude of the child.

It is further seen that where such mismatches occur the foundation for future learning disabilities is predictable.

Chapter III - Assessing Perceptual Development

Exploration of the specific perceptual processes which must reach a stage of adequacy before a child is believed ready to learn or stated otherwise before a child is ready to adapt his capacities to a strategy of learning produced the following considerations.

From many clinical observations it appears that at the perceptual level the child must have developed the ability (1) to differentiate visual forms of like but not identical features; (2) to be able to hold such forms in immediate memory; and (3) to hold in mind the spatial orientation of the forms visually presented for identification and differentiation. At the same time, the minimal auditory perceptual development must include the ability to (1) discriminate between the sounds of the language, one from the other, at least to the point of adequate differential recognition of the majority of sounds used; (2) retain in short term memory a sufficient number of sounds to permit formulation of a verbal structure for both recognition and comparison; and (3) to retain in short term memory the sequential order of sounds in the presenting stimulus in preparation for recognition, integration and formulation of an outgoing response.

It should be recognized that these several capacities may come to a level of adequacy in the maturing child at different times. Most children reach an adequate level of function in the necessary pre-verbal processes by the time they reach school age. For example, being ready to learn to read can be described as the point in time when a given child has reached the stage of over-all readiness to function adequately with a sufficient number of processes that his efforts will be rewarded. However, research has now amply demonstrated that many children may not have developed all or sufficient of these capacities by the time that formal education is undertaken.

Some will be found to be deficient in one capacity or along one modality while other capacities have developed adequately, while others may show an overall lag in perceptual readiness. Thus, it is most important if prevention of reading difficulty in later schooling is felt to be important, for example, that the classroom teacher have as complete an understanding of each child as can be provided. For this reason the Perceptual Test Battery was developed and standardized as a screening device for assessing perceptual readiness. Each sub-scale addresses itself to one of the perceptual processes detailed above.

Studies of various populations of children drawn from both urban and rural schools; from all socio-economic levels; from equal numbers of male and female children; and, from all intellectual levels show that the scales measure in each instance a developing process which excepting in the capacity relating to spatial orientation becomes asymptotic at or during the eighth year.

(Spatial orientation unlike the other processes continues to develop in some children beyond that time.)

This means essentially that each year up to the ninth birthday an increasing number of children develop adequacy in the readiness factors for reading. The importance of this cannot and should not be overlooked. Since it is an almost universal dictum that children must be taught to read (or assisted in learning-to-learn how to read) during their earliest school years when they are six years old. Naturally because of this constraint those children who are not ready to learn because of perceptual inadequacies face a difficult task.

They--the more slowly developing children--are in a sense pressured to attempt reading either by a method for which they are unequipped to function adequately (teaching reading through phonics, for example, to children who have inadequate auditory perceptual development) or, encouraged to read or learn how to read before their perceptual mechanisms are freely and automatically available to them. Quite naturally such children are high risk learners--are more likely to have difficulty with reading as they continue in school. It is with the aim of reducing this potential for poor learning by early discovery of perceptual readiness that the standardization of the Perceptual Test Battery was undertaken.

THE PERCEPTUAL TEST BATTERY

Table 1 shows the perceptual processes assessed by the seven sub-scales of the Battery.

Table 1

Auditory (sounds)	Visual (forms)
Discrimination	Discrimination
Memory Span	Memory Span
Memory,Sequential	Memory, Sequential*
	Memory, Spatial Orientation

*presently under development

Following is a description of each of the sub-scales. Standardization data for each of the sub-scales presented as (a) year-by-year distributions and (b) profiles by age over all of the sub-scales will be found in the next chapter.

Test Description

1. Auditory Discrimination (Wepman, 1958 & 1973)

This is the original test of the Battery. It was first published in 1958. A revision of the test scoring and new norms for the test were published in 1973 by the Language Research Associates, Inc.

Auditory discrimination as assessed by this test is defined as the individual's perceptual processing of aural signals (heard speech) contrasting each phoneme heard with each other phoneme so that fine differences between sounds can be separately distinguished. Research has demonstrated that the ability to discriminate sound differences is developmental in nature, i.e., the ability improves with age in some children as late as the eighth year of life. The ability to discriminate spoken sounds provides the basis for (1) the individual's formulation of verbal symbols in a communally acceptable form, (2) the establishment of an internalized monitoring system for one's own speech and the speech of others and (3) learning the alphabet of sounds that form the aural substructure of phonics in the act of reading.

(Inadequacies in auditory discrimination lie at the root of many articulatory problems and many reading problems. The ability to discriminate sounds seems, from research, to have little relationship to intelligence but like other perceptual processes develops independent of other perceptual characteristics. Morency & Wepman, 1973)

The form the test takes is to ask the subject to listen to word-pairs read aloud and determine whether the two words he hears are the 'same' or 'different'. The test consists of forty such word pairs. Thirty are 'different' one from the other within the word-pairs. The difference in each instance is a single discriminating feature. Ten pairs show their difference in initial consonant phonemes, (bat-kat); ten in medial vowels (loud-lead) and ten in final consonants (cap-cat). Ten additional word-pairs are identical. Each word-pair was selected from comparable sections of the Thorndike-Lorge word count (1944), and according to that published frequency list, are approximately equally familiar to children.

Examples of Word-Pairs:

Initial	Medial	Final
rug-lug	peel-pale	beg-bed
bead-deed	leap-lope	bun-bum
met-net	come-cam	rake-rate

2. Auditory Memory Span (Wepman & Morency, 1973)

This is a test of a subject's ability to recall one-syllable words spoken in series of progressively increasing length. The ability to retain and recall series of familiar but unrelated words (immediate auditory memory span is found to be closely related to the ability of small children to read). As the eye scans a series of words and the child attempts to gain meaning from them, children, as they go through the step of auditorizing and reauditorizing to gain meaning, need to hold in mind the target words. A good auditory memory span for words simplifies this process, a poor or short memory, however, increases the likelihood of difficulty in mastering reading. Similarly, a good or long immediate memory span for words relates to good articulation since the stimulus word can be held in mind while the auditory monitoring system selects the articulatory structure appropriate to the word's expression. Naturally, it follows that a short auditory memory span for words fails to provide the continuing target or time for accurate monitoring and therefore increases the likelihood of inaccurate articulation. In company with auditory discrimination this perceptual process appears to be developmental in nature, i.e., increases with age. However, a somewhat higher correlation with intelligence is found between auditory word memory span than between intelligence and discrimination. The correlations are positive but low. In a factorial assessment the two perceptual processes are found to be positively correlated.

The subject is asked to repeat the words he hears beginning with a set of two words and continuing progressively through a series of six words. No meaningful relationships exist between the word series, i.e., each word is spoken out of context with preceding or following words. The words used were all selected from the five-year old word frequency listing of A SPOKEN WORD COUNT (Children), (Wepman and Hass, 1969), and while not completely equated for familiarity are known to appear in the vocabularies of five-year olds. All words used are single-syllable common nouns, pronouns and adjectives. Three trials at each length series is given and span is determined both by the longest series recalled (in any order) and by a weighted score crediting achievement on first, second, or third trial.

Example: Dog - ... Shoe
House - ... Tree ... Person
Man - ... Cup ... Horse ... Car

3. Auditory Sequential Memory (Wepman & Morency, 1973)

This is the familiar digit span (forward) sub-test used in many assessment devices (WISC, Stanford-Binet). Recall of digits is used here as a method for assessing sequencing ability rather than simple recall. The retention of a digit series in the exact order heard relates to the task in speech and reading for maintaining the correct expressive sequence of phonetic events. Developmental discrepancies are often found in this ability as the child struggles to attain his initial phonic attack on reading. A poor sequencing ability produces the common reversals of sounds and syllables found in many beginning readers and while often unrecognized adds to the confusion in trying to produce accurate speech articulation or accurate oral reading.

The ability to sequence as a special form of immediate recall relates factorially to memory span for words yet for some children appears to be a unique problem unrelated to other perceptual functions. It assesses the subject's ability to repeat a series of just-heard digits in the exact order in which they were heard. Two trials at each span length are given. The test is scored by (1) longest sequence recalled in order, and (2) differential weighting of recall on first or second trial.

Example: 9 1
8 3
2 .... 4 7
6 .... 3 9
5 .... 8 .... 6 4
3 .... 9 .... 7 6

4. Visual Discrimination (Experimental form to be published in 1975)

This is a test designed to assess the subject's ability to judge relatively gross differences in visually presented forms. The art of reading requires the ability to distinguish relatively fine differences in orthographic form prior to its application in reading, however, there appears to be a developing capacity to detect form differences which relates to the task of reading at a later time in the over-all developmental process. While for most children this prelinguistic form distinction is well developed by school age; when it has not yet developed, it may lie at the very root of a reading disability.

In the development of visual form discrimination there appears to be a process of stabilization of the visual processing of data--when stabilization has not been achieved the error patterns children select indicates the type of instability a child may have which may be more instructive than a simple count of errors. Some research suggests that visual form recognition errors of rotation may be more closely associated with difficulty learning to read than to other error types. Because this appears to be true in a fairly large number of children with learning disabilities, a separate test has been devised to explore recall of orientation in space.

The forms are all original drawings, designed specifically to avoid invoking verbal intermediaries. A page with five forms on it is presented to the subject who must then select the two forms on the page that are identical.

The three false choices on each page differ from the Target in one of the following ways: 1) different shape, 2) parts re-arranged, 3) part added or missing, 4) tilted, 5) upside down, or 6) mirror image. While the score obtained is essentially an addition of correct identifications, additional information of a child's difficulty can be made by an analysis of the types of errors he makes.

5. Visual Memory (Forms) (Experimental form - to be published in 1975)

The test is designed to assess the span of ability to retain and recall free forms. This ability to hold forms in short-term memory for immediate recall is a perceptual task closely related to the act of learning to read. In reading the child must hold alphabetic forms in mind while he processes the total visual image for its meaning. An inadequate recall ability produced the continuous need for visual restimulation with a resultant loss of immediate accuracy as the eye scans the printed page. The consequence is delay, word-by-word reading and development of the bad habit of guessing about the meaning from inadequate clueing. In the pre-linguistic form recall span as assessed by this test a child's adequacy in the ability and consequent readiness for reading can be seen. Beginning to learn to read before a sufficient span has been developed may lead to serious consequences in the delay it causes in reading fluency.

Factorial analysis of test battery protocols shows visual discrimination and span of recall to be highly correlated. Like other perceptual processes the span of visual recall develops progressively through the first eight years becoming asymptotic thereafter.

The test uses a multiple-choice format. A Target page presents a single form to the child--after a 5-second observation a four part multiple choice page is exposed -- one of the four forms being identical with the target form. The task is merely to identify by pointing to the identical form. The error choices vary in (1) completeness (missing parts); (2) additional parts or as (3) distortions. The test becomes progressively more difficult as the number of discriminating features are reduced.

6. Sequential Order Recall (Experimental form--to be published when standardization is completed)

A special type of memory that is empirically related to reading is the span of ability to hold a given sequence of forms in immediate or short term memory. The act of reading requires a span of sufficient length to permit fluent whole word scanning. Studies show that like the other perceptual processes this sequential order recall develops progressively through the first eight years of life and becomes asymptotic thereafter. Beginning reading before a sufficient sequential order span has been developed leads to letter and syllable reversals with consequent loss of or difficulty in obtaining accurate meaning. Often delays in the automaticity of whole word recall produces the need for constant visual restimulation and a consequent slowing of the reading process.

The test designed to determine span of sequential order recall begins with the presentation of a target sequence of three blocks each containing an open-ended design. When placed in juxtaposition a single gestalt is formed. After viewing the target gestalt a three part multiple choice page presents the three blocks in three different orders--each forming a gestalt--one of the three is identical to the gestalt of the target page. The series are presented in progressively longer sequences up to seven blocks in number in twenty items.

7. Spatial Orientation Memory (Wepman & Turaids, 1971)

This is a test designed to assess the ability to retain and recall the orientation (direction) of visually presented forms. The ability to do this with ease and facility shows the preparation of the child for the task of left-right discrimination and is thought to be related to the child's maturing ability to orient himself in his life space.

Visual spatial organization is one of the most specific of the perceptual processes. Unlike the other processes assessed by the battery, children show increases in their spatial orientation ability beyond the eighth year.

Rotation of observed forms is commonly noted in such visuo-motor tests as the Bender Visual Motor Gestalt Test and the Benton Visual Retention Test. The present test, however, avoids the motor aspect by its multiple choice answer form thereby reducing the confusion of the cause of error--whether it be a visual or a motor problem.

The first items (1-6) explore the basic recognition of horizontality and verticality. The remaining items (7-20) test the retention of and recall of oblique spatially oriented figures.

The test consists of a booklet made up of 20 original designs and an equal number of multiple choice arrays of designs in different spatial orientations. A target design is exposed for five seconds followed by a four-part multiple choice set of forms in different orientations--one of the latter is identical in orientation (and form) with the target. The task is to point to the figure of the multiple-choice forms in the same orientation as the target. The task becomes increasingly harder as the test progresses with all variations within a 90 degree arc. All forms used are original free forms not easily identifiable by verbal intermediary.

The Perceptual Test Battery with its age-related standardization has been designed to accomplish two goals. (1) To assess the perceptual readiness of children for formal education through an explication of the prelinguistic visual and auditory processes. (1a) To determine the modality preference (visual or auditory) of children as they approach the task of learning, especially the task of learning to read.

(2) To assess the specific lags in perceptual development in children who have evidenced difficulty in learning to read despite adequate intellectual, emotional and physical propensities.

It is with the dual aim of establishing the unique learning style of individual children and the possible effect of failing to achieve such a match in early educational years that the present research into perceptual process readiness was undertaken.

In the next chapter the standardization data and the distribution of abilities in each of the processes studied will be shown.

Chapter IV - Confirmation

Confirmation of the hypotheses set forth in the earlier chapters were sought in a series of field studies using the Perceptual Test Battery. The chapter begins with the methodology used in determining the meaning of the scores obtained on administration of the test battery. Following the methodology section, illustrative data bearing on (1) perceptual processing as a developmental characteristic; (2) the modality distinction; and, (3) the reliability and validity of the test instrument. The studies are presented in chronological order to show how the Battery emerged over time.

METHODOLOGY

Scattergram analysis of protocols obtained in a series of pilot studies indicated clearly that in an unselected normal population of children 5 through 8 years of age the results could not be described parametrically. A left skewed curve was obtained on each of the sub-scales. This is shown in Graph 1 where the results of testing an unselected group of children at 6 years of age with the Auditory Discrimination Test illustrates the distribution of scores.

See Graph 1

Since our concern was with the children who were most seriously delayed in development those scores two or more standard deviations below the mean were noted as representing approximately 15% of the total population. At that time an Adequate/Inadequate dichotomy for each of the sub-scales was used.

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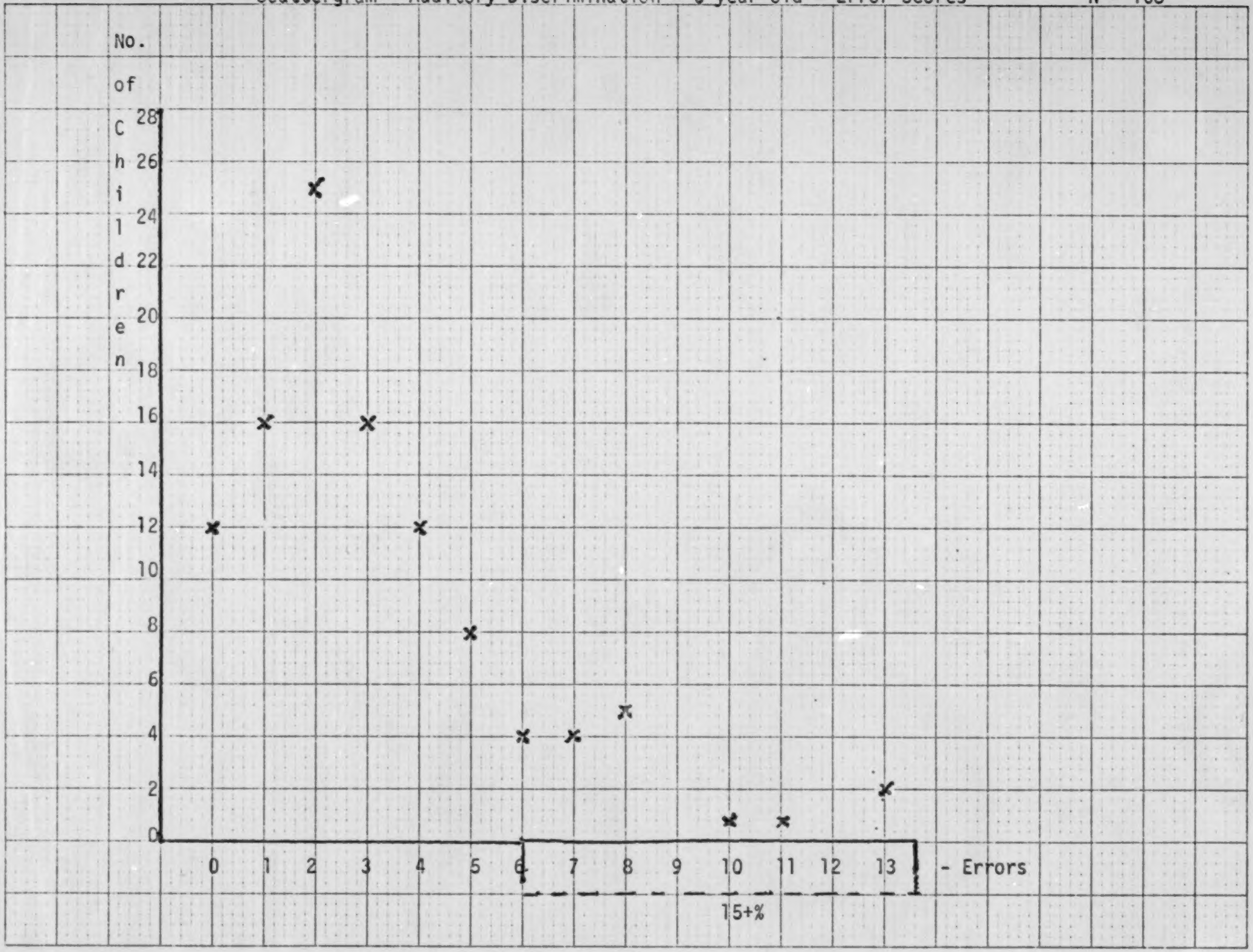
GRAPH 1

Scattergram - Auditory Discrimination - 6 year old - Error Scores N = 108



Children in the lowest 15% were considered inadequate to the tasks required of them. No gradations of adequacy were defined. As more data was amassed in different studies a refinement of this approach was developed. By converting the raw scores into a Z type distribution scaled scores could be used to great advantage both in ease of scoring and in interpretation. Table 2 shows the percentile categories arbitrarily selected to produce a useful Z score.

TABLE 2

Scaled Score Categories	Percent of Total
+2	15%
+1	20%
0	30%
-1	20%
-2	15%

Using the scaled score categories has these advantages. (1) Each category reflects a range of scores rather than a single raw score. This helps to eliminate some of the problem occasioned by the arbitrariness of single responses. (2) It increases the usefulness of the tests as longitudinal measures of change. The examiner comparing two test administrations can tell at a glance whether the changes made were significant i.e., did the change move a child from one category to another or was the change only within a category. (3) It permits the highlighting of the scores that fall in the INADEQUATE range in the lowest 15% of children at a given age. Clinical experience had indicated that these children had not reached a stage of readiness for instruction in higher processes (like reading) until further perceptual development in that process occurred or until through compensatory instruction the child could learn to avoid the undeveloped aspect through additional clues. (4) It helps identify easily the more successful or more fully developed children indicating the various degrees of readiness for formal verbal instruction. (5) It shows clearly the specific areas of strength and weaknesses in children over the age of 8 who are having difficulty in school.

Table 3 shows the conversion of raw scores to Z type scale for children age 5. A similar conversion table for each age 5, 6, 7 and 8 is to be found in Appendix A.

See Table 3

Another way of studying the data which serves to show the developmental nature of the individual perceptual processes is illustrated in Table 4.

See Table 4

As can be seen from Table 4 at each age level each of the categories shows progressively different distributions. For the teacher concerned with a particular perceptual process (such as Auditory Memory Span) the individual child's problem can be seen in relation to that process alone. Conversion tables of this nature for each of the perceptual processes are to be found in Appendix B.

DATA FROM PREVIOUS STUDIES - presented chronologically

Study I - Brookfield, Illinois - 1961-63

Study entitled: Speech Inaccuracy in Children as Related to Etiology

In this study designed essentially to explore the speech articulatory accuracy of 5, 6, 7 and 8 year old children of different etiologies the original test of the battery--the Auditory Discrimination Test--was used with the results as shown in Table 5.

Table 3

(5-year old Profile)

Conversion Table for Raw Scores
5 year old subjects

Name ______________
Date ______________
Age ____________

Conversion Categories	AD	AM	AS	VD	VM	VOMT
	30	60	70	20	16	20
						19
+2	29	50	50	18	14	16
		32	27	15	11	14
	28	31	26	14	10	13
				13	9	12
+1	27	27	19			11
			17			10
	26	26	16	12		9
	25	24	14	11	8	8
0				10		
	24	22	10	9	7	7
	23	21	9	8		
	22	19		7		
-1	21	17	8		6	6
	20					
Adequacy Threshold	19	16	7	6		
	18	15	6	5	5	5
			5	4	4	4
	13	10				
-2	12		4	3	3	3
	11	8	3	2	2	2
	10*	2	2	0	0	0

*AD scores below 10 invalidates the test. SAME score of less than 7 also invalidates test.

Table 4

Age-related conversion table for Auditory Memory Span

Rating Scale*	AGE			
	5	6	7	8
	60			
	59			
	58			
	57	60		
	56	59		
	55	58		
	54	57		
	53	56		
	52	55		
	51	54		
	50	53		
	49	52	60	
	48	51	59	
	47	50	58	
+2	46	49	57	
	45	48	56	
	44	47	55	60
	43	46	54	59
	42	45	53	58
	41	44	52	57
	40	43	51	56
	39	42	50	55
	38	41	49	54
	37	40	48	53
	36	39	47	52
	35	38	46	51
	34	37	45	50
	33	36	44	49
	32	35	43	48
	31	34	42	47
		33	41	46
	30		40	45
		32	39	44
			38	43
+1	29	31	37	42
			36	41
	28	30	35	40
		29	34	39
			33	38
	27	28	32	37

Rating Scale*	AGE			
	5	6	7	8
	26	27	31	36
			30	35
0	25	26	29	34
	24	25	28	
			27	33
	23	24	26	32
			25	31
	22	23	24	30
	21	22	23	29
	20	21		28
−1	19	20	22	
		19		27
	18	18	21	26
	17	17		25
Adequacy	16	16	20	24
Threshold	15	15	19	23
	14	14	18	22
	13	13	17	21
	12	12	16	20
	11	11	15	19
	10	10	14	18
	9	9	13	17
	8	8	12	16
	7	7	11	15
−2	6	6	10	14
	5	5	9	13
	4	4	8	12
	2	2	7	11
			6	10
			5	9
			4	8
			2	7
				6
				5
				4
				2

*Rating Scale Legend for Interpretation based on cumulative frequencies

15%	+2	indicates very good development
20%	+1	above average memory span
30%	0	average memory span
20%	−1	below average memory span
15%	−2	below level of threshold of adequacy

TABLE 5

Comparison of Children Grouped by Articulation Errors

NORMAL ARTICULATION			ARTICULATION ERRORS		
Age	Adequate AD	Inadequate AD	Adequate AD	Inadequate AD	*
5	31	10	7	4	(6)
6	34	6	11	7	(5)
7	32	7	10	5	(4)
8	32	8	2	1	(3)
Totals	129	31	30	17	

(*Number of errors for inadequate AD)

It is very evident by inspection that the children in the articulation error group have more difficulty in auditory discrimination than do the normals studied. Statistically the difference is significant at the .01% level. Expressed as a percentage, 31/160 or 19% of the normals showed inadequate auditory discrimination, while 17/47 or 36% of the articulatory group showed auditory perceptual difficulty. A special speech handicapped group--a population of children with cleft palates was also studied. While no age breakdown was collected for this group, of the 30 children with cleft palates, 19 showed inadequate scores - or (19/30) - 63%. This is by far the largest percentage of children the writer has seen with poor auditory discrimination. A further check of mild hearing loss should be done with this group before the discrimination figures are accepted at face value. One of the characteristics of the cleft palate child is a mild and frequently overlooked hearing loss. (Wepman, J. M. & Gaines, Frances P., 1949).

Study II - Wheeling, Illinois - 1964-67

Study Entitled: School Achievement as Related to Developmental Speech Inaccuracy.

The Perceptual Test Battery was employed in this study to differentiate children with speech articulation problems from those without such problems in terms of their school achievement. The battery used at that time included two auditory and two visual subtests as shown in Table 6.

See Table 6

It should be noted on Table 6 that the perceptual test scores obtained in year one of the three-year study were significantly predictive of third grade achievement.

The developmental nature of the four subscale battery was shown in the study by the mean differences in performance by children in the first and third grades as shown in Table 6.

See Table 7

As can be seen on Table 7 a significant change occurs in perceptual processing with age.

The relationship between the perceptual tests used and two measures of intelligence were explored in the study. Tables 8A, 8B and 8C show the results.

TABLE 8A

Relation of Perceptual Processes to Intelligence

First grade - N=177

	AD	AM	VD	VM
Peabody IQ	-.290	.120	-.120	-.106
Lorge-Thorndike IQ	-.240	.101	-.44	-.167

Table 6

Perceptual Factors Correlated with School Achievement

N = 177

First Grade Scores

Metropolitan Third Grade Achievement	Visual Discrimination	Visual Memory	Auditory Discrimination	Auditory Memory
Word Knowledge	.246**	.240**	.348**	.237**
Word Discrimination	.238**	.267**	.274**	.313**
Reading	.244**	.237**	.235**	.274**
Spelling	.244**	.270**	.283**	.304**
Language Usage	.205**	.132	.239**	.271**
Punctuation	.274**	.199**	.305**	.289**
Language Total	.269**	.190**	.306**	.312**
Arithmetic Computation	.231**	.214**	.286**	.213**
Arithmetic Problem Solving	.264**	.256**	.291**	.246**

* Significant at .05 level
** Significant at .01 level

Table 7

Perceptual Modality vs. Achievement

Mean Differences Between Scores at First and Third Grade Levels

Test	N	Mean Score Difference (improvement)	Standard Error	t
Auditory Discrimination	172	3.436	0.412	8.34*
Auditory Memory	177	-.305	0.076	-4.01*
Visual Discrimination	177	2.424	0.130	18.65*
Visual Memory	177	2.797	0.150	18.65*

* Significant at .01 level

TABLE 8 B

Second Grade - N=177

IQ	AD	AM	VD	VM
Peabody Picture Vocabulary Test	-.252	.166	-.44	-.149

TABLE 8C

Third Grade - N=177

Peabody Picture Vocabulary Test	-.179	.154	-.129	-.96
Lorge-Thorndike	-.188	.271	-.233	-.274

As is evident on Tables 8A, 8 B, and 8C that little if any significant relationship exists between the perceptual factors and intelligence at least as the latter is assessed by the standard instruments used. Similar low positive correlations were obtained in each of the studies.

Study III - Wheeling, Illinois - 6 year longitudinal

Study Entitled: School Achievement as Related to Speech and Perceptual Handicaps

Further evidence of the validity of the Perceptual Test Battery is seen in the number of significant correlations between the Perceptual Test Battery (four subscale version) administered when the children were in the first grade and their sixth grade School Achievement scores on the Metropolitan Achievement Test. These are shown in Table 9.

See Table 9

Table 9

Significant Correlations between 1st Year Perceptual Processes and 6th Year Achievement

Total Population N = 120

1st year scores	Auditory Discrimination	Auditory Memory	Visual Discrimination	Visual Memory
MAT's				
Word Knowledge	.27	.25	.22	
Reading	.26	.23	.22	
Spelling		.20		.22
Language Usage	.28	.22	.22	.20
Parts of Speech				
Punct. & Capitals	.19	.33	.22	.18
Language Total	.27	.32	.28	.24
Language Study Skills		.22		.21
Arith. Concepts & Problems		.23	.33	.28
Arith. Comput.		.26	.23	.31

underline - at .01%

no underline - at .05%

Study IV - Upper New York State - Reported April, 1972

The Perceptual Test Battery used in this study included an additional auditory test--the Auditory Sequential Memory Test--the Battery included then three auditory and three visual tests--1008 children were studied by volunteer school psychologists--50 children per examiner--the increasing capacity by age for all five of the processes is clearly shown on Table 9.

See Table 10A

This study included in its population all ethnic groups, inner city as well as suburbia. The sample is large enough to account for variations due to educational opportunity; possible deprivation and other factors which might effect the established norms. Further, as Table 10B shows a reasonable sample by sex of subject was studied.

TABLE 10B

Distribution of Children
by Age and Sex

Age	5	6	7	8	Totals
Female	65	74	143	208	490
Male	65	80	156	217	518
Totals	130	154	299	425	1008

No significant differences in test scores by sex were found at any of the four age levels. This finding is of importance since it suggests that in use of the Battery the sex of the subject can be disregarded.

TABLE 10A

Age group means and standard deviations for scores on the Perceptual Test Battery

	Age Group							
	5		6		7		8	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Aud. Discrim.	24.7	4.4	25.3	3.2	26.5	2.7	27.2	2.7
Aud. Memory Span-Raw	4.0	.7	4.2	.8	4.6	.8	4.7	.7
Aud. Memory Span-Wgtd.	23.0	7.8	26.0	8.9	29.6	9.8	31.2	8.8
Aud. Sentence Test	9.8	2.1	10.7	2.0	11.5	1.9	12.4	1.8
Aud. Sequencing Span-Raw	4.2	1.0	4.6	.9	5.1	1.1	5.4	1.1
Aud. Sequencing Span-Wgtd.	6.2	1.9	6.8	1.6	7.9	2.0	8.4	1.9
Visual Form Discrim.	11.8	2.4	12.9	2.3	14.2	1.6	14.6	1.5
Visual Form Memory	8.2	2.7	10.0	2.3	11.1	2.2	11.8	2.1

Aud. Discrm. 5-6: $p < .210$, $t = 1.258$

The stability of each of the subscale tests was explored using either test/retest or split-half correlational methods wherever appropriate.

Table 11 shows the results obtained.

TABLE 11

	AD	AM	AS	VD	VM
AD	.89				
AM		.74			
AS			.67		
VD				.56	
VM					.61

1. Split-Half (Spearman-Brown)	2. Test/Retest
AD	AM
VD	AS
VM	

Using a specifically designed computor program the cumulative data from all of the studies over the past ten years a grand total percentile distribution of scores on each subtest was produced. Using the arbitrary percentiles (converted Z score categories) determined for each level of achievement over each age 5, 6, 7 and 8 (see Table 2). The computor program shows the raw and weighted scores falling in each proficiency category permitted an automatic (computor determined) allocation of scores obtained in each specific percentile group.

Normative data on unselected populations from five studies were combined to derive expectancy tables for each of the subscales of the Battery. These are illustrated in Table 4 page 30. The end product--score and conversion tables for the Battery as a whole by age appear in Appendix A and for each of the subscales over age in Appendix B.

SUMMARY

The empirical data collected in a number of individual field studies demonstrates:

1) The developmental (increased proficiency by age) nature of the perceptual processes tested by the PTB.

2) The reliability of the assessment instrument both subscale by subscale and for the battery as a whole.

3) The positive relationship between the perceptual battery and achievement both in school subjects and in speech.

In a later chapter (VII) the manner in which this data collected on unselected normal populations can be used to determine:

1) The modality of choice as indicated by increased proficiency in one modality over the other for any child.

2) The various perceptual strengths and weaknesses of specific processes for any given child. (Since in each process explored with one exception--visual orientation--the level of achievement becomes asymptotic during the eighth year. Older children--above 8 years of age--show clearly where a perceptually based learning problem may exist if they fail to achieve as expected.)

Chapter V - The Right-to-Read-Right; Matching Instruction to the Child's Learning Style

The modality preference perceptually determined concept is a step into an educational future only distantly apparent on the horizon. Engulfed in the need to provide mass education for a growing population, the early educational effort has become stereotyped to the mean. Schools have become the rallying point for a bureaucratic status quo where everyone reads a little and no one is helped to read well. Overlooking in the search for mass literacy the object lesson of individual differences the educational establishment has settled for mediocrity for all -- by whatever means.

Intermittent outbursts of fads, gimmicks, audio-visual aids emphasizing commercial ends, part-truths and partial success with selected populations has first, colored our texts and in widely dispersed areas become our educational faith. From so-called 'progressive education' to the 'open classroom' where nothing is taught but the opportunity for growth is a permissive freedom from structure might well be thought of as completing a cycle, from nothing to nothing. The product of such education has become a barren wasteland where those who can by nature of their endowment acquire the communication skills preparatory to abstract integrative synthesis without or even despite educational intervention all leaves behind the much larger 'silent' majority who cannot learn without guidance and training. The result a growing population of poorly trained, partially educated and largely semi-literate children.

The right-to-read has become the right to read anyway one can--to read with only partial understanding--to read enough to get by--to meet national standards of such a minimal level that individual thought, creativity and self-expression are unstimulated. The regression to the mean has become the goal--

only the gifted who by their own bootstraps, as it were, have been able to rise above it.

The present argument is for a return to the simplicity of psychoeducational reality. Where the goal of education is not that everyone be taught or exposed to a given method--or a provided text resulting in a mold of inconsequential speed of reading almost without thought, but at least as good as ones peers, to an individuated goal of personalized capacity to acquire meaning through thought. It argues for adjustment and adaptation to at least the grossly unique characteristics of each child. It bridges the gap which seems to be ever widening between learning-to-learn how to read and learning-to-learn how to think, which this writer believes should be the goal of education.

The conceptual schema advanced to bridge the gap between what we know of developmental differences and the cookbook style of learning by rote, by redundancy and repetition. To learn to read the right way for each child through taking advantage of his innate idiosyncratic development within the framework of mass education.

It tries to tie together in one small but important part that is represented by the psychological and neurophysiological developmental pattern of children a rational educational approach to formal learning.

Taking our lesson from the insights of the past, from such observations as Charcot's 'audile, visile, tactile' learning typology (1953) derived from his studies of brain-impaired children and adults; from the observational schemata of Piaget's brilliant microscopic elaboration of observed developmental stages; from the logic of Chomsky (1957) and Lennenberg (1964) in their recognition of language universals; from Osgood's model of development

(1963), and from our own clinical observations of language delayed children and language impaired adults came the direction for the present model of human learning and development.

Children are different in the way and manner in which they naturally acquire language. While they are alike in the stages of development; while they react to the environment, assimilate knowledge, and adapt to the conditions by which they are faced as they mature, they do so each in their own way--each in their own time. Psychological and physiological readiness followed by use prepares the child for further more complex functions. Their course, the modality they will follow throughout their lives is set genetically--the environment provides the stimulus for advancement. No amount of attention or parental drive or expectation, however, can alter what or how the child's developmental pattern will unfold. If by nature, by genetic endowment, the preferred pathway for learning is audile--that modality will develop most rapidly, most accurately and most usefully. Speech efforts will change from babbling and jargon into intelligible production early. Articulatory accuracy will proceed as the auditory processes reach a stage of developmental adequacy in discrimination and retrieval of perceptually (subconsciously) acquired self-monitoring of sounds. Through this means the child acquires increased facility with maturation and use. Reward and reinforcement, stimulation, external stress and emphasis may hasten the process--but no amount of external force of parental or adult expectation can alter the child's basic capacity. These external events can neither hasten or obstruct the capacity--they can and often do effect the performance effort not always to the child's benefit. When the child is ready accuracy of oral expression of language will proceed through a regular preordained course. Obstruction often results from misdirected--mismatched attempts to stimulate a given child before he is ready. This external force often makes him seek adaptations to satisfy external needs before or in a different manner than is natural for him. Thus, early in a child's life--before the educational institutionalized effort--during the very critical age of pre-school years when the child is most flexible and most vulnerable when it appears that any mode of stimulation is good and proper the wrong approach for a particular child is so often fostered with its potential for psychological frustration.

The non-audile child--the visile or tactile child--whose preferred developmental pattern is other than auditory, speaks later, is less intelligible when he does speak, less adequate in learning what he hears in his auditory contacts with his environment. Probably nothing effects language development more deleteriously than our ready acceptance of the averages for language or speech acquisition widely published and accepted with blind faith. However, not all children are ready to talk at any given chronological mean age. There is no prescribed time for first words or phrases or sentences to appear. This is in fact the real conclusion of the statistical approach--not a criticism of it. For every child who talks (uses words meaningfully) at or above the mean--there must be another who talks at or below the mean--that's what the mean means. The reason for mean time for meaningful words to appear in language usage is true in just what it says--but so often misinterpreted. No amount of external pressure can alter this simple statistic. In relation to speech use the audile child is usually above the mean--he is advanced in his use of intelligible speech. He has the nature--the preferred modality to take advantage of environmentally conditioned auditory stimuli--his ear (peripheral and central) can accomodate, adapt, mimic and echo what he hears. The strongly 'visile' child on the contrary whose auditory modality is less well developed or is developing more slowly is just not ready to acquire aural accuracy to guide or stimulate his production. He speaks intelligibly later in life--

he articulates less well when he speaks--his jargon remains jargon longer. He falls below the mean. But it should not be overlooked that unless this were true, the mean itself would be meaningless. Some children must be slower at acquiring accurate speech and others faster to have an average. It is this difference in modality preference that accounts in a large part for the mean being where it is. Of course, some children speak later than others and when they speak inaccuracies appear, distortions continue, "speech is defective".

In a study of very bright children in a select population where verbal stimulation was relatively constant, over 40% of entering kindergarten children had some speech inaccuracies and this number only fell to 25% when they reached grade one. (Lab School study; Wheeling study.)

Today, with increased psychological sophistication this modality preference and its consequences are easily accepted. Yet at the point of educational or parental intervention it is most often overlooked. The notion of readiness to learn all the same way by all children is so ingrained that little or no credence nor acceptance is given to the child below the mean of readiness. He is either mislabelled and mischaracterized as 'slow', 'speech defective', 'mentally retarded', or 'emotionally disturbed'. Something about him is wrong--not something about the attitude and action of the parents or the school or the methods used or the parental/school guidance, but about the child. Therefore, he needs to be re-adjusted. He is the subject of our attention. He is the center or our effort. He becomes a 'problem child'. The goal becomes one of molding, shaping him into our stereotyped image that every child is ready to learn--or to learn-to-learn--at the time expected of him. Learning problems, perceptual or otherwise are as often iatrogenic as they are child produced. If child A is not ready we set about to make him so. His parents are counselled, special classes and therapists are provided for him. He is often labelled as a 'learning disability' long before he has had a chance to learn. Society is so certain that he is at fault--we even medicate him when in his attempts to escape our ministrations (which are all for his good) he becomes hyperactive, or euphemistically, hypoactive. Or, if his escape route is withdrawal, we medicate him otherwise because he is too passive--we seek a magical medical answer to a psycho-educational problem. The mismatch between child and method--it is here held--is frequently caused by the parent/education society in which the child must function. It is here that conformity living up to expectations is rewarded and differences often punished.

The educational effort to act as though all children learn in the same way at the same time and by the same methods has become so pervasive that by all available studies over 25% of our children fail to learn in the educational system. It is surprising with this state of affairs that the number is not higher. It is an educated guess based on much experience that at least half of the children labelled as learning disabled are the victims of the rigidity of our system--of an inflexibility in our thoughts which fails to account for the differences in children but elects to insist upon an equality of assets.

Again, this is not an argument against language universals, against statistics, against the need for good parent/child relationships or parental stimulation--it is an argument that children are different in very important ways--this difference is expressed at least in some part in learning typology. Matching the child's education, parental or school --his stimulation--his approach to learning to his modality preference at the very earliest time possible in his educational career is one of the more important ways that educational intervention can be individuated, and thereby, hopefully avoid at least in some part the 'visile' child being taught phonics before his ear (perceptually) has reached a stage of adequacy where he can function operationally without seeking negative, apparently adverse, neurotic escape patterns.

Or, the 'tactile' child whose most rapid gains are in coordination and physical development is accelerated being forced into a sight reading program for which he is inadequately equipped, et cetera.

There is nothing so complex being suggested--the complexity is in being able to identify as early as possible what pathway--which modality of approach--in method is best for each child.

Fortunately, most children are sufficiently advanced in all of their modalities by the time they reach school age that our misguided efforts have little--at least apparent--effect. They learn despite our best efforts to misguide and misdirect them. They learn-to-learn because they are sufficiently bright or adaptable to offset our stereotypic structure of education. At least apparently they show no overt signs in the age-span of early education--from K through grades 2 or 3. One can conjecture, of course, how we may be setting the stage for many of the borderline cases later becoming 'problem children' in their later educational efforts but at this point this would be pure speculation. Yet, it appears to be true that in so called delinquency prone areas--the non-delinquent children are all readers. They enjoy the vicarious learning of reading for pleasure as well as for escape. The delinquent children, however, show a high degree of reading inadequacy. They often read, but poorly, without pleasure, without the joy and fun of creativity which reading enhances, because it brings to the child all of the past creativity accumulated over the years of civilization since Gutenberg discovered the printing press.

More importantly we need to focus on the 25% who fail to learn--who become categorized and labelled and often segregated as learning problems or learning disabled for reasons which lie within themselves. No claim is made here that adjusting our curriculum to the proclivity or preference of the child is in any way a panacea, an answer to all of our educational ills, it is seriously proposed that it is one important step in what might be done to eliminate what may well be a most vital point in a child's future adjustment. The very least we can do is be aware of the differences--and be as flexible as our system permits to provide an educational effort of potentially maximal use to the children.

Turning now to some initial evidence for the viewpoint expressed above, there appears to be a beginning trend towards recognition of the problem and some of the answers that flow from it.

In the educational field Kirk and his associates (1968) in their development of the ITPA showed very evident modality distinctions in the organization of their now widely used psycholinguistic test. While concentrating on the conceptual level where modalities are of equal importance they also included attention to the pre-operational sensori-motor level along modality oriented lines. Frostig (1968) and Ayres (1972) in their establishment of visuo-motor tests and methodology for training the child who lagged in this respect of learning showed a similar recognition of differences in children. Birch et al (1964) in their studies of cross-modal integration carried the modality concept another step forward--as did Benton (1959) and others (Graham & Kendall, 1960; Wedell, 1973) in their studies of visual form recall and perceptuo-motor handicaps.

The adequacy of visuo-motor developmental ability is also to be gained inadvertently through the more and more widely used picture drawing projective tests. While designed as subconsciously produced mirrors of internal psychological 'states of mind' the picture drawing techniques such as the Draw-a-Person Test (DAP), the House-Tree-Person Test (HTP), and the more recently produced Kinetic Family Test (KFT), all reveal to the student of perceptual development a level of visuo-motor maturation. In fact, while the projective nature of such test instruments have sometimes been brought into question the evidence they yield of the perceptual visuo-motor capacity is there to be seen and evaluated by any clinical observer. The widely used Bender-Gestalt Visuo-Motor Test (Bender,1938) is properly titled as an assessment of visuo-motor adequacy where applied to children. There is little question about the developmental difference in hand-eye coordination with increasing age from the time a child can hold a pencil or crayon until he has gained full competence in line and form production stemming from perceptual recognition and integration as shown by the Bender Test.

Scientifically studied by Myklebust (1965) the development of handwriting relates very directly to competence in discrimination, memory and sequential recall, the three cornerstones of the perceptual modality developmental competence processes. In this aspect of development the advanced 'tactile' or 'tactile-kinesthetic' child shows a distinct advantage over his more slowly developing 'audile' and 'visile' peers. Too often this factor is overlooked in the over-all consideration of individual children.

The modality preference concept holds that Charcot's principle of 'learning style' differences among children has been confirmed. Children differ in degree and proficiency of their idiosyncratic learning style. They become more and more adequate in all of the perceptual processing abilities with time, as their embryonic nervous system differentiates into its more complex structure capable of more complex behavior. Auditory, visual, and tactile-kinesthetic sensory and motor proficiencies reveal their idiosyncratic preferences through both receptive and expressive behavior. Proprioceptively aided feedback monitoring of self-behavior sets up personal, internalized guide lines for future behavior. This unwitting preferential development of one modality over the others is indicative of the genetic nature of 'learning style' which it is believed remains a type of birthright followed throughout life.

The modality concept of differential sensori-motor development--the concept of preferential audile, visile or tactile-kinesthetic learning typology--while causally related to inherited factors is markedly effected by environmental conditioning and rewards for behavior which meets the wish fulfillment needs of parents and teachers.

Fortunately, most children develop their perceptual proficiencies without directed pressures--the innate factors continue their inviolate progression from infancy on without undue regard to external events--to parental pressures--to even well-intentioned though often misguided adult expectations. For example, regardless of the parental wish for early use and clearly enunciated speech, the more slowly developing child tends to speak more clearly--only as his auditory processing abilities become more functional.

By school age--five and older--modality preference is reflected in the child's visual and visuo-motor functional adequacies combined with the degree of development of audiological competency. External pressures can do little to assist this developmental internally instigated, congenitally derived 'choice'. The individual differences in development both in rate and in preference stand out to the alerted observer. The almost total failure of the adult world to recognize these differences; to take advantage of the differential proficiencies; to provide stimulation in the specific areas of competency and individuated choice, however, stands out equally. Society has a need for intelligible communication among its members--a primitive survival need in every species but especially so in humans. This is seen by society's unconsciously recognized drive for conformity in self-expression by the children. Society spawns to maintain itself. So strong is this need for verbal symbolic expression that the fact that different children reach a stage of learning-to-learn at different times and in different ways is almost totally overlooked. Coupling the adult need with the child's unique functional capacity development will be possible only as the adult world--parents and teachers--become aware of each child's uniqueness, of his needs, as the attempt is made to begin to match the two in both formal and informal training and environmental conditioning. Some of the results of the failure to provide a proper match between instruction and developmental strengths and weaknesses will be seen in the following pages.

Chapter Vl- Perceptual Inadequacy. Its cause and effect.

Despite the fact that our society has become increasingly technological and consequently more dependent on performance skills than upon verbal ones the highest premiums and greatest rewards continue to be placed on verbal proficiency. Intelligence is more often than not equated with vocabulary, with language orally used or graphically portrayed. School systems are geared for the most part to verbal academic advancement in the three r's--to reading, writing and arithmetic--as it has been for countless years. Technical abilities, vocational and avocational, are either relegated to an adjunctive role or reserved as a catch-all for those who cannot or have not succeeded in the type and degree of verbal usage expected of them or have not progressed as rapidly in learning to speak, to read, to write or to spell. Successful achievement is held to be commensurate with the ability to communicate in words.

This disparity between the growing need of our society for skilled and unskilled technicians and our continuing attitude that verbal proficiency is the prime indicator of intellectual development has produced an educational dilemma. Since parents and educators set the guide lines that lead to rewards, children are forced to comply or failing to do so are considered inadequate.

Learning disabilities are invariably referred to as failure to achieve the level of adult expectancy in verbal proficiency. Underachievement with all of its negative connotations is more often than not underachievement only in verbal behavior. Yet, psychologically or sociologically society can only progress technologically as an increasing proportion of the population develops nonverbal skills, interests and aptitudes.

Almost without exception whether a school system practices permissive, structured or any of the variants between the two in its curricular intervention the developing child is rewarded for possessing a high level of proficiency in those processes which lead to further and steady progression in verbal behavior. Perceptual inadequacy as a result is assessed in terms first of readiness for verbal learning as the child begins his formal education and even before this time in his preschool life. Progress is further assessed and the child labelled as misfit or as a potential underachiever in his educational advancement as he enters and continues through the second stage of his cognitive development--the learning-to-learn stage--chronologically between 5 and 8 years.

This age period is roughly equated with the Piagetian developmental concept of pre-operationalism. Piaget observed that as the egocentric, sensori-motor and pre-operational stage where thought and behavior were internalized and self-centered, the child begins to make use of symbolic, cognitive thought--begins to live and learn vicariously rather than concretely. In the present concept it is during this stage that the child is fashioning his own unique learning style as demonstrated by the development of his innate perceptual capacities. It is at this point in the life cycle that the self-contained egocentrism changes to the societally oriented external world. It is at this time that the literal form of any inadequacies in development as he reaches the higher grades of school (approximately the fourth grade and above) when he is judged almost solely by his ability or abilities to learn symbolically and vicariously. It is at this stage in the developmental and educational life cycle that underachievement regardless of intellectual (as assessed by either so-called tests of intelligence or by tests of achievement in school subjects) has its roots; where potential learning disabilities becomes demonstrable inadequacies.

Perceptual inadequacy then must be defined as the failure to develop for whatever reason physiological or psychological, those necessary subconsciously acquired perceptual capacities such as discrimination, recall and sequential memory which lead to and play such a vital role in both the acquisition and accuracy of performance in verbal learning whether it be in how one learns to speak, read, write, or spell.

Educators and psychologists who recognize one of the more salient dilemmas caused by this--the differential development of children especially in the early years--are hopefully growing in number becoming at least an active minority.

Were the goals and methods of achieving success in education centered on assisting the child to think, to adapt, to function independently and not considered as an acquisition by rote or otherwise of contextual data, a learning disability would need to be otherwise defined.

However, psychoeducational reality demands verbal proficiency and underachievement is failure or potential failure in verbal skills. It is to this end the clarification, meaning, and effect of a true learning disability as distinguished from a problem in learning that the present monograph is directed--the how and why of underachievement as defined by societies' expectations.

No disagreement with the general developmental schema proposed by Piaget and his adherents (1960) is seen in this description of perceptual readiness for learning, nor with Osgood's (1963) concept of the invariate development of the pre-operational, sensori-motor stage of development in the hierarchy of learning. The range of time in a given child's life when adequacy in perceptual functioning is held to occur is through the eighth year of life for some children as was noted in previous chapters. The perceptual stage may begin its developmental progression within the first year of life but for some children continues through at least the eighth year. Inadequacy of perceptual development is often the product not of a true physiological or psychological failure in the child but rather in the society established value system which has failed to take into consideration the age-range of normal development.

As has previously been stated (see Chapter II ; pgs. 7-10) it is held theoretically with considerable and increasing empirical evidence that in the hierarchy of learning, perceptual skills are held to be the necessary building blocks for full development of conceptual behavior and use of verbal symbols. Initially, this is seen in the formation of words and later in the acquisition and use of syntax or grammar in spoken as well as printed language.

Perceptual ability develops in all children but at different rates of speed and at different times in their chronological life. The evidence is clear that the age range for this invariable sensori-motor pre-verbal development extends to and through the eighth year of life (see Chapt.IV). These factors are repeated here for emphasis--an emphasis needed because our educational demands on all children are based on the unsupported myth that all children are ready to learn-to-learn at or about six years of age.

For most children, fortunately, this is true--they are ready to learn-to-learn at that age. Some are ready auditorially--they can acquire and use the discriminations and recall of sounds with relative ease and accuracy. In educational terms they are prepared to learn to read through phonic instruction. Other children are less proficient developmentally in auditory processing but have developed readiness for learning their own strategies through visually emphasized skills--phonics for these children may be more difficult to master at an early school age but as they mature perceptually sounds and letters can and do become integrated proficiently.

Unfortunately, neither the auditory nor the visual modalities are sufficiently developed in some children at the six-year old age of adult expectancy. These children become the potential underachievers. If as most schools operate and as most parents expect the child is passed through grades in a regular year by year progression they learn-to-learn poorly. Their phonic abilities are approximated rather than accurate; the visual skills needed for rapid form recognition and recall (the basis of reading, writing, and spelling) are to various degrees inadequate to the task. Failing to live up to expectation they encounter criticism, denigration, even rejection. This may have as one would expect far reaching negative psychological effects upon many of them. In today's psychological vernacular they become easy prey to frustration, to anxiety, to the development of withdrawal behavior, to being 'turned off' of education and of school generally, without knowing why. They are classified as learning problems, as mentally retarded or as emotionally disturbed children, depending to some degree on the educational vogue of the day or of a particular school.

Since this occurs at a time when their unformed minds are impressionable, when they are highly suggestible to adult and peer attitudes and behavior, the scars on their psychological maturation may be intense. On occasion they may turn to less mature activities through easily seen regression behavior. Because of the social pressures of parents and teachers; because of the 'no failure' policy of many schools (the exceptions are few to the point of rarity); because of the competitive peer relationships aided and abetted by parents and schools, they may react aggressively if that is their nature, or if that is the pattern of reaction of significant others with whom they identify in their early childhood. They may on the other hand react passively and just 'go along' until permitted by age to actually 'drop out' of school. Careful observation of children in their early school experiences will show that they have 'dropped out' of attempting to learn long before they physically withdraw. This type of psychological withdrawal is sometimes seen in the form of truancy or as actual misbehavior or in many instances as hyperactivity--or its converse hypoactivity.

The last few years has seen a tremendous upsurge of interest in these children as the fact of the consequences of their failure becomes evident. Special schools, special classrooms, special tutoring--special attention of one sort or another is foisted upon them. They are in a sense rewarded for their failure. The nucleus for their future is set. Once labelled as underachievers, as failures, they are unprotected. They have no choice but to become problem children.

Of the perceptual processes which must reach some combination of adequacy before a child can develop a useful personal strategy for verbal learning or which when the time for developing their own strategies is forced upon them, probably the most important in both auditory and visual modalities is the developing skill of discrimination. In very simplistic terms this means the ability to recognize fine differences between the sounds (phonemes) of spoken language and the forms or shapes or order of the orthographic alphabet. Linguists (notably, Jakobson and Halle,1952) have spelled out in considerable detail how discrimination of sound differences develops progressively with age from the recognition of gross multifeatured differences to single discriminating feature differences. Progression is noted in the differentiation of vowels from consonants--between the vowels themselves--and finally between and among the consonants.

Speech accuracy is closely related to the increasing development of a child's auditory discriminatory power. Not alone must the child recognize such differences but must establish, although unwittingly, a self-monitoring system to guide his own accuracy of production.

Given time, that is until roughly the eighth year, most children will have developed automatic sound discrimination ability. The exceptional children--those who do not develop adequate discrimination of sounds--are often subject to a number of continuing speech problems.

1) Their speech accuracy may continue to show articulatory substitutions or elisions; they may not respond to speech therapy.
2) Attempts to teach them reading through an emphasized phonic approach may continue to result in failure to learn to read with facility.
3) Their peer relationships as well as their reactions to significant adults may suffer if either of the foregoing is markedly evident.

Auditory discrimination as a developing perceptual process has been clearly identified as the primary process underlying speech inaccuracy in many children. Empirical evidence indicates that at least two other auditory factors contribute to the same communicative skill, namely, memory for the sounds discriminated and the rather special form of phoneme recall of sequential order. While these three often are closely linked in the developmental process of learning to speak--each may show functional independence of maturation and use.

Auditory memory for sounds like its counterpart auditory sequential memory is found to be not infrequently below the level of adequacy even while discrimination improves. When either process is slow in development the speech effort may be ineffective. Thus, speech therapy which is designed to help the child eliminate errors in spoken language may well be misdirected if limited in its training to specific discrimination or particular single phoneme correction. The speech therapist should be prepared to recognize and direct therapy to the memory factor as well. By exploring and identifying the specific auditory mal-development, counseling the child's teacher (and parent(s)) as to the specific weakness in development becomes most important.

Just as auditory discrimination, memory and sequential order recall of sounds is closely related to spoken language, the same visual factors relate essentially to reading and to writing. In learning-to-learn to read, the child must possess adequacy in form recognition (discrimination), in form memory (recall) and in the special type of visual recall of sequential order retrieval.

Unlike the other perceptual processes spatial orientation memory seems related to much more than learning to read. It appears to reflect the child's orientation of self to the world around him--to his right/left discrimination--to his own body image. In some children the failure to develop adequate orientation in space leads not only to reading inadequacy but to self-inadequacy in relating as they must to their environment. If these factors separately or combined are slow in development or show inadequacy because of some visual pathology or developmental lag, the individual child may show considerable initial strategy difficulty in either phonic or sigh training approaches to the reading act. This developing process seems in many ways unlike the others--first, in development itself, the ability to recall the orientation of visual images in space is unique among all the perceptual processes studied since it has a longer developmental range. Studies of older children and even some adult studies show a weakness in spatial orientation development and progression.

Phonics it must be recalled is the act of combining the phonemic/phonetic alphabet with the orthographic alphabet. The complexities of the developmental integration between auditory and visual processes produces in some children (a significant number from Birch et al's research [1964]), a stumbling block to initial stages of learning-to-learn to read even though the child shows adequate development of each of the identified auditory and visual perceptual processes.

It follows quite naturally from this that early identification of specific perceptual process inadequacy in either modality or in the integration of the two is essential--just as supportive and corrective therapy or training will have its greatest chance of success if directed at the specific perceptual process or processes rather than at the level of meaning.

In its simplist form before meaning can be extracted from the printed page with comfort, ease and pleasure--with facility--the child must be assisted in obtaining facility at the pre-verbal perceptual level. As will be seen in later examples of individual case histories not only do some children fail to develop an adequate personal attack on learning to read and therefore may be classified as non-readers but an uncountable number learn to read imperfectly and continue throughout their future life as poor or inadequate readers. Special educators, tutors or remedial reading specialists who ignore the imbalance of perceptual development while concentrating on teaching or therapy directed at the conceptual meaning-level often find that despite their best efforts, despite the evident adequacy of intelligence or of educational opportunity reading skill remains at a low level.

No absolute level of development in the specific perceptual processing abilities--no particular combination of such skills can be generalized as being necessary at a level of adequacy before learning to read. Some children can learn by compensatory substitution of strengths in one perceptual modality for an as yet underdeveloped one--other can adapt their own strategies to fit the selected method of the school or teacher because of generalized high intellectual ability that permits considerable flexibility in approach. The majority of potential underachievers, however, as well as the older school failures are the rule rather than the exception. Self-compensation without guidance is less common in the child of average or below average intellectual ability.

It should be especially noted that while it is not difficult to identify these two groups with present methods--by alerted educators and parents and techniques developed to offset their handicaps, the schools seem to be filled with a 'silent minority' of some size who fall into neither category. They learn to read, passably. They progress through at least the elementary grades from year to year below the mean of their peer group but never or at least rarely, enjoy reading or accomplish it with ease and comfort.

Society is becoming more and more aware of the non- or poor-reader and the gross underachiever and developing legislation and teaching emphasis to equalize their opportunity (See California's Master Plan for Special Education, 1973, as an example), however, the children who fall below the mean, who are simply poor readers are all but lost from sight.

The present writer like others has elected to clarify our understanding of the non-reader, potential and real. At the same time, it is felt that an equal effort should be made in research and in teaching to recognize the less handicapped--the normal child whose learning remains below the mean. This is felt to be especially important as the children involved pass into the higher grades--into later elementary and high school--for here semi-literacy no matter what its cause produces much of the educational problem--and may account for the highest percentage of 'drop-outs' at the mandatory legal age for compulsory education as well as the plethora of behavior problems which are rapidly becoming the source of educational concern.

The etiology of perceptual inadequacy is without question multi-faceted. Some children, perhaps the greatest number although empirical evidence for this is presently not available, are inadequate simply because of lags in developmental rate. Others are inadequate because of physiological pathology limiting and even obstructing the developmental process. For example, pediatricians have for some time concluded that there exists a 'clumsy child syndrome' (1965) which is more than developmental in nature. Pediatric neurologists, speech pathologists and neuropsychologists point to delays or failure to develop language in a condition called 'aphasia' due to pathological cortical conditions, both congenital and acquired. Because the medical profession is so often called upon to explain to parents the reason for certain children to develop language usage more slowly than others--and even at times not to develop useful oral language expression when expected they have created a syndrome--Minimal Brain Dysfunction (MBD) or Minimal Brain Impairment (MBI) whereby symptomotology usually only behavioral in nature, is the cornerstone of the diagnosis. The minimally brain-impaired child who demonstrates no neurological pathology in the sense of 'hard' physical signs but who behaves in the same manner as a brain-injured child, is said to learn or fail to learn in the same manner as the child with demonstrable neurological deficit. This, the present writer, believes to be an extremely unfortunate label for it classifies children as suffering from neurological deficits which are recorded and virtually impossible to expunge from the child's records--all without proof. To the present--neither the child's parents nor the child himself has available means for reversing this process or its consequences in the educational treatment of the children.

Congenital aphasia--acquired at birth through trauma or as the result of neuroautomical pathology without question effects the development of perceptual processing and limits the developmental progression leading to oral language, learning readiness. Myklebust and Johnson (1967), Eisenson (1966) and others have pointed out the auditory imperfections in such children. Certainly others with localized neurophysiological pathology in the visual cortex rather than the auditory fail to develop visual perceptual processes necessary for reading--while oral language may develop in such children learning to read and write may be seriously effected. Often such children are labelled 'dyslexic' rather than aphasic. Recent or yet unverified reports have identified a relationship between defects in the semi-circular canal areas responsible for balance and specific reading disabilities.
Treatment for this condition has been proposed or is being sought by reducing the semi-circular canal disturbance through motion sickness medication. At this point both the condition and its treatment is highly hypothetical and awaiting scientific replication.

Within the past decade as pharmacology and biochemistry have made such tremendous advances in knowledge there has been a tendency to turn to medication as an answer to the 'slow' learner. Drugs to increase alertness, attention and reduction of hyperactivity are enjoying a vogue out of all keeping with known etiology. Magical answers are being sought for non-magical conditions. Because of the limited time factor since drugs have been used little, if any, empirical research is available on its efficacy.

Unfortunately, many children have been subjected to 'drug' treatment without evidence that the 'pill' is either efficacious or indicated--further, the necessary research on side effects on the future learning of children subjected to 'drug' treatment has yet to be done.

It is this writer's opinion from experience with 'drugged' children that the treatment of learning disabilities by this means is at present unwarranted--more proof is needed that the drug is beneficial, that there are no deleterious side effects, that a child can discontinue the drug without suffering from withdrawal.

Without wishing to enter the polemic of society seeking a way to end drug abuse generally it seems premature to subject children without demonstrable evidence that they need drugs or any such treatment.

For the most part learning disabilities due to perceptual handicaps, it is believed, are best considered as a psychoeducational problem. The prevention and remediation should lie in the hands of the psychoeducator with the assistance of the child's parents--not as a medical problem unless that problem can be identified by other than behavioral indicators.

SUMMARY

Perceptual inadequacy at the time in a child's life when he is learning-to-learn is seen as a major cause of the frustration at the onset of formal schooling which may set the tone for a child's continued educational difficulty. The need to recognize this and balance it with more realistic goals on the part of parents and teachers is felt to be vital if education is to be maximally usefull to the child. Some of the specific problems that may arise have been noted when the schools ignoring individual differences in child development tend to produce a situation where failure is almost certain to follow.

The present tendency to look for a magical medical cure for the psychoeducational problem is discouraging since it fails to meet the reality of intervention but limits its benefits to reducing the immediate reaction formation of the child when faced by an intolerable situation.

In a following chapter illustrations of the type of learning disabilities caused by failure to develop the perceptual processes when expected and the kinds of training which can be used if the specific perceptual handicaps as well as the child's strengths have been determined.

Chapter VII -- Learning Disabilities

(The following chapter is reprinted with permission in its entirety from the report of the Task Force on Learning Disabilities of the Issues on Classification of Children, Principal Investigator, N. Hobbs, 1974.)

Many professional disciplines, medical, psychological and educational have attempted to identify children with learning disabilities. Medicine expressed an early interest in the localization of functions in the brain led to the identification of a wide range of difficulties exhibited by brain-injured adults in speaking, writing, reading, and understanding speech. Physicians working with children then began to report somewhat similar difficulties, which they termed "congenital auditory imperception" and "congenital word blindness" and which they attributed to brain injury. The World War I epidemic of encephalitis directed the attention of physicians to various behavior disorders in children associated with brain damage resulting from this disease. Studies of cerebral palsy identified a clumsy child syndrome and minor cerebral palsies and demonstrated that cerebral palsied children might exhibit associated disorders of perception and learning. Epidemiological studies of Pasamanick and Knobloch (1966) and others indicated that minimal brain damage might be much more common than had been supposed. In the medical literature, a number of terms have been used to categorize these children. Among them are included such terms as: minimal brain damage (Tredgold, 1908), clumsy child syndrome (Gubbay, 1965), minimal cerebral dysfunction (Haring & Miller, 1969),

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hyperkinetic syndrome (Laufer & Denhoff, 1957), hyperactive child (Strauss & Lehtinen, 1948), hypokinetic behavior disorder (Wigglesworth, 1963). In American medical circles the term minimal brain dysfunction (MBD) has come to be preferred (Haring & Miller, 1969).

A number of non-medical disciplines have been concerned primarily with the learning problems presented by these children rather than the implied pathological etiology of each condition. Speech pathologists and audiologists have been involved with children who seemed unable to comprehend speech, although they were not deaf, or who were severely retarded in the development of speech. Terms such as congenital auditory imperception, congenital aphasia, developmental language disability have been used to designate such children. Educators interested in the teaching of reading (together with some opthalmologists, optometrists and child psychiatrists) have identified children with severe reading problems, whom they have designated by such terms as dyslexia, specific reading disability, primary reading retardation, or strephosymbolia (Haring & Miller, 1969). Following the work of Strauss (1948), which demonstrated specific perceptual disabilities, the term perceptually handicapped child has gained some currency. In 1962 the general term learning disabilities was suggested by Kirk. This term was adopted by the influential Association for Children with Learning Disabilities and by the United States Office of Education and has now come into general use in educational circles. In 1970 the National Advisory Committee on Handicapped Children developed the following definition: "Children with special learning disabilities exhibit a disorder in one or more of the basic psychological processes involved in understanding or using spoken or written languages. These may be manifested in disorders of listening, thinking, talking, reading, writing, spelling, or arithmetic. They include conditions which have been referred to as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, developmental aphasia, etc. They do not include learning problems which are due primarily to visual, hearing, or motor handicaps, to mental retardation, emotional disturbance, or to environmental disadvantage."

Unfortunately, there is little agreement either in medicine or in education on criteria for identifying children with minimal brain dysfunction or learning disabilities. Because the disabilities presented by these children are extremely heterogeneous, the search for any commonality in symptoms, pathology, or etiology has so far been fruitless. For example, pediatric neurologists have established sufficiently reliable criteria for identifying as brain-injured those children who show clear-cut signs of central nervous system pathology; disagreement develops, however, in the observation and interpretation of less clear neurological evidence (so called "soft" signs) and becomes heated if the concept of minimal brain dysfunction is extended to include children who exhibit only behavioral and learning disabilities, with no clinical or historical evidence of brain injury.

Use of the term minimal brain dysfunction in this broader sense has had a number of unfortunate consequences. Although this term was originally suggested specifically to avoid any necessary implication of actual brain damage, it has had that implication in the minds of many parents, teachers, and children. Since nothing can be done to repair brain damage, this classification has often implied an unnecessarily pessimistic prognosis. It has had an adverse effect on many parents' level of aspiration for their children as well as on the self-concept of many children. It has led many school districts to require neurological examinations for admission to special education programs, resulting in unnecessary medical expenses and unreasonable demands on already overburdened pediatricians and pediatric neurologists.

Present educational procedures for classification of children with learning disabilities are equally unsatisfactory. There is, for example, great diversity in the terms used in different state statutes, as the following examples indicate: educational handicap (California), specific learning disabilities (Florida), extreme learning problems (Oregon), communicative and intellectual deviations (West Virginia), neurologically handicapped (or impaired) (Connecticut, Nevada, and Oklahoma), perceptually handicapped (Colorado, Indiana, New Jersey and Washington), brain damaged (Pennsylvania), learning disability (Delaware). Generally, responsibility for definition of the criteria for admission to special programs for these children is assigned to a state board of education or to a commissioner of education. In practice, criteria are seldom made explicit, and authority for determining whether particular children are eligible for admission to the special programs is usually delegated to local committees that are often unqualified to make such diagnostic classification. There has been little uniformity from district to district or from state to state in the characteristics of children classified under these various statutory rubrics.

Without explicit criteria, estimates of the prevalence of learning disabilities have ranged as high as 20-30 percent of the total school population. Where school districts are able to obtain additional state or federal funds for each child enrolled in a special class, there has been some tendency to assign almost any child who was having difficulty in school to special classes for children with learning disabilities.

The lack of clear definition of this category of handicap has not only created problems in the control of special education funds; it has also vitiated much unfocused educational, psychological, and medical research. The inconsistent results obtained in much of this research are a consequence of the great heterogeneity of this population and the fact that research samples drawn from an ill-defined population can be expected to differ widely merely by chance.

General terms such as minimal brain dysfunction and undefined learning disabilities have no consistent meaning and no value as a basis for the development or the application of corrective methods. Efforts must be directed toward more precise and objective definitions of relatively homogenous sub-groups. If order is to be imposed on this confusion, there must first be acceptance of the fact that the population of children involved is heterogeneous. Then, criteria must be established whereby the appropriate professional discipline can reach a reasonably mutual understanding as to what a child's problems actually are. Such criteria will ensure appropriate referral to qualified professional personnel and will protect the rights of the child and his parents.

PURPOSES OF CLASSIFICATION

Educational. For the purpose of individualized intervention some means of classifying children with learning problems is necessary. The school system needs to recognize those children who are not succeeding. It must also be able to recognize the difference between two major groups of children with learning problems. The first, the underachievers with no apparent or determinable problem may indeed make up a great percentage of thosechildren who have been improperly classified as suffering from a learning disability. These children--children who are slower to learn than others, or children who are emotionally disturbed, or children who lack a proper educational background and stimulation for learning--should not be considered as suffering from a learning disability. On the other hand, certain children must be identified by the school system as capable of adequate intellectual activity but unable to acquire a mastery of educational material without special assistance. The identification and intervention proposed for such children needs to be specific to the child and his problem. The school system and its adjuncts must be prepared to provide the special education necessary to assist these children.

Psychological. Continuous failure to achieve as expected is likely to have a continuing, even a progressive, debilitating psychological effect upon a child. Peer relationships often suffer. The children are frequently unable to meet the real or fancied expectations of parents and teachers. The period of early education is especially critical. Starting education "on the wrong foot" may well influence the child's total educational future, not merely his immediate learning. Misclassification, followed then by improper treatment in special programs, may produce more lasting effects than the difficulty in learning. Because of this negative process and because this time in a child's life is so critical for the development of psychological stability, the classifier must exercise extreme caution in labelling children. Where the risk of creating a psychological disturbance in a given child is greater than the potential for assisting him through special educational procedures, the decision should be not to classify. Errors of classification which tend to create increased psychological problems are difficult to remedy, have pervasive and longlasting effects, and often produce situations which may require the school system to seek highly specialized therapeutic assistance.

Medical. The medical profession has taken an increased interest in learning problems as parents and schools have requested reasons for the behavior of the children. The medical profession not only must identify syndromes of behavior but also must properly classify those children whose learning problems may result from neurological or physiological disability. Most important, the medical profession must not assume a medical reason without establishing acceptable medical criteria for the determination.

An immediate case in point is the growing tendency to prescribe medication for children suspected of having a learning problem, even though no medically verifiable condition has been or can be determined. Aside from the dangers involved in the introduction and use of drugs--since neither side effects nor aftereffects have been verified through sufficient research--the medical practitioner should use such prescriptive treatment cautiously.

Parental. The parent of any child classified as having a *learning disability* needs to understand the meaning of and reason for the classification and the role of the educator or physician in the diagnosis and handling of the problem. The parents should act in the child's interest if they believe the identification is improper. They also should have recourse to some specific form of appeal, both from the label and from the planned course of training or therapy. Further, wherever possible parents should be part of the special training program. Parental-guidance programs should be established by the schools to maintain continuity and consistency of expectancy and handling of the child at home as well as in the school. (See also Chapter Twenty in this volume.)

The Child. Educational intervention to offset or compensate for a learning problem should be specific to the problems of each child involved. Classification, with its aura of identification of a problem and its proper remediation, must always be considered in terms of the individual. Since the source or etiology of a particular learning problem may vary from specific to generalized areas of learning, the question of type of intervention will be dealt with separately.

Governmental. The state and federal governments need a classification system that permits a consistent evaluation regardless of where or by whom it is made. Such a system will ensure that the funds made available for the remediation of the problem are accountably allocated. The over-all need is great, but the funds available are limited and should be carefully allocated within a demonstrable and practical classification system.

DEFINITION OF SPECIFIC LEARNING DISABILITY

"Specific learning disability", as defined here refers to those children of any age who demonstrate a substantial deficiency in a particular aspect of academic achievement because of perceptual or perceptual-motor handicaps, regardless of etiology or other contributing factors. The term perceptual as used here relates to those mental (neurological) processes through which the child acquires his basic alphabets of sounds and form. The term perceptual handicap refers to inadequate ability in such areas as the following; recognizing fine differences between auditory and visual discriminating features underlying the sounds used in speech and the orthographic forms used in reading; retaining and recalling those discriminated sounds and forms in both short and long term memory; ordering the sounds and forms sequentially, both in sensory and motor acts (Wepman, 1968); distinguishing figure-ground relationships (Frostig, et al 1961); recognizing spatial and temporal orientations; obtaining closure (Kirk & Bateman, 1962); integrating intersensory information (Birch & Leford, 1964); relating what is perceived to specific motor functions (Kephart, 1963). Impairment of the processes involved in perception may result from accident, disease or injury; from lags in development; or from environmental shortcomings. Impairment of perception may distort or disturb the cellular system and/or the normal function of one or more sensory systems.

From this definition it follows that perceptual or perceptual-motor inadequacies produce specific learning disabilities. Learning problems due to emotional, socioeconomic, or peripheral sensory or motor impairment are excluded. Behavior disturbances, severe generalized mental retardation, poverty, disadvantaged educational opportun visual impairment, hearing loss, or muscular paralysis all may produce educational problems, but do not fall into the classification of specific learning disabilities. For example, a child who is deficient in learning because of an emotional disturbance, but who shows no perceptual or perceptual-motor problem, would not be classified as having a learning disability. On the other hand, a child who is deficient in learning because of a nutritional problem, and also shows a specific perceptual or perceptual-motor deficiency caused by the nutritional problem, would properly be classified as having a learning disability. As an additional example, a child with a demonstrable hearing loss as a primary cause of his lack of classroom adjustment or adaptation might also have a visual perceptual deficiency as a secondary but contributing factor to his difficulty in learning in the classroom. He should be classified as a child with a hearing loss and a specific learning disability.

In each instance, then, regardless of other contributing factors or primary etiologies, only when a perceptual-motor deficiency is determined should the term specific learning disability be applied. Poor intelligence alone should not be the basis for the classification of specific learning disability, although there will be some degree of correlation between very good intelligence and good perceptual ability, just as there will be some correlation between poor intelligence and poor perceptual ability.

From a purely educational point of view, the etiology of a specific learning disability is relatively inconsequential. The identification of the perceptual problems involved indicates the area of assistance necessary. The direct cause of the perceptual handicap may be maturational or pathological; however, the demonstrable handicap itself is of major importance to the special educator.

EVALUATION

Evaluation of children should be based upon a referral from the child's classroom teacher. The referral should indicate the manner in which the teacher believes the child to be deficient. In each educational system the most qualified examiners should be used. These should always be educational personnel. Wherever possible, the examination should be made by a trained psychologist or special educator. If such specialists are unavailable, personnel experienced in testing and evaluating children such as the school's remedial reading instructor, speech therapist, or teacher-nurse should be responsible. The examinations can be made by the school's regular classroom teachers if those teachers have had previous experience in testing. However, the evaluation should not be made by the child's present classroom teacher, nor should the classroom teacher make the decision for final classification.

Upon referral the examiner needs to establish two essential factors: (1) the primary cause underlying the educational discrepancy (Differential Diagnosis); (2) the nature and extent of the perceptual handicap producing the specific learning disability if it is found to exist.

Differential Diagnosis

In order to make a complete and accurate evaluation, the examiner should have an adequate school and social history of the child. Where this is not readily available or is incomplete, such information must be acquired at least by the time of final determination of the differential diagnosis. Actual direct study of the child can proceed while such information is being collected.

Direct evaluation should proceed with an over-all view of the child's intellectual capacity and his present intellectual performance. The examiner should establish the intellectual level through the use of standardized tests of intelligence. The age of the child to be assessed and the qualifications of the examiner should govern the selection of the test instrument to be used.

Parenthetically, the restandardization of many of these instruments, to eliminate what is felt to be an underlying ethnic bias, is under consideration. If new standards for intelligence tests are developed and show adequate reliability and validity, the examiner would be free to substitute such new assessment devices if he feels that a more reliable estimate of intellectual ability can thereby be determined. Until such a new standardization has been achieved, however, it will be necessary for the examiner to interpret the effect of ethnic background, socioeconomic dependency, and bilingualism on the scores obtained.

At this stage the examiner may determine that the child shows a severe, generalized primary mental retardation and recommend such a classification by referral for specialized training or special room placement to the school authorities. Before he makes such a recommendation, however, he should be sure that the child's low intelligence test attainment is not based on the presence of pervasive perceptual or perceptual-motor problems. Where such conditions suggest themselves by the child's behavior, it is most important that misdiagnosis be avoided. The generally mentally retarded child should not be classified as having a specific learning disability although he may also have perceptual problems which can be given attention in his special classrooms.

The next stage of evaluation should follow from clues obtained in the original referral, during the initial interview with the child and the parents, and in the school and social history. When the question of overt behavior or an emotional disorder is suggested as the essential cause of the educational problem, the examiner should explore the emotional stability of the child, his self-concept, and his personality characteristics. The examiner can use any one of a number of widely-used projective techniques to aid him in this determination. For younger children, where language development and usage may be a problem, non-verbal projective tests should be used. For older children, the examiner should feel free to use both verbal and non-verbal projective instruments. Since projective tests have not been fully standardized, they should be used subjectively and not form the sole basis for classification. Caution must be exercised in the interpretation of protocols from all projective instruments since reliability and validity data is most often lacking.

If the initial examiner concludes that the essential problem is an emotional block toward the learning process, confirmation should be sought from other professional sources. The conclusion should not be based on a single examiner's findings, no matter how well trained or experienced he may be. Note, for example, that children with a language problem due to a specific visual or auditory perceptual problem may project unusual and even bizarre appearing protocols, or their verbal responses may be due to some undiscernible perceptual handicap. If an examiner even suspects that a child may have such a handicap, further exploration of the perceptual processing abilities should be made before any final decision is made to classify the child as a behavior problem or as emotionally disturbed. If no question of perceptual problem exists, however, the child should not be classified as having a specific learning disability.

Further, some children's behavior problems may be the result of a perceptual handicap. The perceptual handicap must be considered secondary to the existing emotional disturbance at the time of the evaluation but still must be considered in any over-all special education program. Where both problems are present, the behavior problem must be resolved before the perceptual problem is subjected to specific intervention.

Finally, during the interview, from the school and social history, and from direct observations during earlier testing, the examiner must take cognizance of any evidence of a primary visual impairment, hearing loss, or muscular paralysis. If such factors appear, the examiner should make appropriate referrals--usually through the school nurse or school physician--to resolve these possible blocks to educational achievement. Resolution or correction of these problems should precede further evaluation of a potential perceptual problem. When such conditions are confirmed, the child should not be classified as having a specific learning disability, but rather according to his primary handicap. In all instances, after the child's primary problem has been resolved, his perceptual processing ability should be re-evaluated.

Identification of perceptual handicap. A wide variety of standardized and non-standardized assessment instruments have been developed to explore the equally wide variety of conditions labeled learning disabilities. At this time, however, no single diagnostic instrument of adequate reliability and proven validity is available. Some of the existing instruments are in the form of batteries of sub-tests; others are individual assessment devices for specific functions. Some tap achievement; others were designed to assess developmental processes.

Most such batteries explore both conceptual and perceptual processes. The examiner must use only those instruments or sub-scales that depict perceptual functions. (That is, discrimination, memory, orientation, figure-ground relationships, closure, intersensory integration, and motoric adequacy.) While attentional factors may be present, the ability to pay attention to a task is not in and of itself a perceptual problem but may be a counterpart of every perceptual process. The perceptual processes listed are not all inclusive. They represent those processes which to this point have been identified sufficiently as factors underlying the learning act. As others are isolated and confirmed through research, they should be added to the list.

No attempt will be made here to recommend any of the present approaches being used. Rather, the reader can make use of a number of collections of test instruments. The most extensive source of such material is to be found in the Seventh Mental Measurement Yearbook (Buros, 1972). Two recent collections of considerable value are Principles of Childhood Language Disabilities (Irwin & Marge, 1972) and Methods for Learning Disorders (Myers & Hammill, 1969). These books include instruments for assessing language, intellectual, achievement and perceptual abilities. The clinician is advised to consider carefully the instruments selected for use in differential diagnosis as well as in defining the perceptual handicap. Any assessment instrument selected for use should meet the criteria listed in the American Psychological Association publication Standards for Development and Use of Educational and Psychological Tests, (French & Michael, 1966).

Assessment should always be in terms of the individual child. Wherever possible, comparisons of the child's abilities should be related to published norms provided for each test instrument used. The decision to classify a child should be based not only on the obvious test results but also upon the child's behavior and other observations made by the teacher, the school nurse, and others involved in the evaluation.

REVIEW BOARD

Each school system should establish a review committee, composed of its most qualified faculty (preferably instructors) responsible for (1) confirming the diagnosis and classification determined, (2) approving recommendations for placement for special training, (3) periodically reviewing the child's performance after placement, (4) declassification when the child is prepared to discontinue special education, and (5) functioning as an appeal board for parents who question the classification and/or intervention program (Cruickshank, et al 1971).

The establishment of such a review board would meet the standard expressed by the American Psychological Association's Committee on Ethics in Research with Human Subjects (Cook, 1970).

QUALIFICATIONS AND TRAINING OF SPECIAL EDUCATION TEACHERS

Very special training is needed by the teacher of the child with a specific learning disability. Experience working with the handicapped of any kind would be of additional value but should not be considered the basic criterion for working with this particular group of handicapped children. The teacher must be trained to recognize the individual aspects of perceptual development and to understand the role of the various perceptual processes in the total learning process. A background in the neurological and psychoneurological characteristics of these children as well as a grounding in developmental theory is essential.

The teacher must be further equipped to provide a general curriculum for the teaching of reading, mathematics, handwriting, and spelling and should have undergone a basic educational program in motor skills and training in prescriptive teaching leading to a proper perceptual-motor match.

The teacher's training also should include an understanding of language problems in childhood and the labels commonly attached to them, such labels as childhood aphasia and its various kindred disorders, dyslexia, agnosia or apraxia. Children with these problems frequently also show specific learning disabilities. Studies have shown, for example, that in aphasic children auditory inadequacies of a perceptual nature are basic to the language handicap (Johnson & Myklebust, 1967).

The teacher should be equipped and trained in remedial educational principles and should appreciate the value of supportive as well as compensatory training. The teacher should be prepared to handle the behavior problems that arise from frustration and failure within the student population; consequently each must be well grounded in psychological principles of counseling and educational guidelines.

Special consideration should be given to the training of a corps of university professors to establish adequate programs wherein teachers of perceptually-handicapped children can receive training. Such professors in training centers must know the subject matter that is advised for the teacher. These university professors would need to undertake direct supervision in training of the new teacher corps. A learning disabilities teacher then would have to be a graduate of an approved learning-disabilities program (Cruickshank, 1972).

GUIDELINES FOR INTERVENTION

The goals of intervention "refer to systematic attempts over an extended period of time to make some changes which we hope will be substantial and lasting in the functioning of an immature (impaired) organism." (Gray, 1971) There must be an insistence that the human subject emerge from the experience unharmed and, if possible, with an identifiable gain.

Several factors must be considered before a program of intervention designed to reduce or resolve a specific learning disability is established. At this time, only general suggestions can be made. Each such program must in a sense be tailored to the needs of a community and, whenever possible, designed to meet the needs of each child. Certain important features, however, should be recognized and implemented as resources are developed locally.

Each educational community should aim at establishing resources on the bases of the age and number of children involved, the availability of qualified personnel, and the financial support available from local, state or federal agencies. For example, large urban school systems may have sufficient children to establish individual classrooms for special educational assistance; smaller schools in a large community may find it more feasible to establish a program in a central location, where children can be referred at specified times.

Small, isolated schools may need to establish facilities for a learning-disabilities specialist, who, like a visiting nurse, can spend a day or two a week on a pre-planned schedule at each of several schools. In such situations children would participate in regular classroom activity and receive tutorial assistance for their handicapping conditions. The classroom teacher would need to follow special instructions provided by the special education teacher at the time of her visit.

Research has demonstrated that a child's perceptual processes are not completely developed until he is at least nine years old (Flavell, 1963; Wepman, 1968). Therefore, for children at the early elementary age level, a direct approach in which the intervention can be specifically related to the perceptual impairment should be established with as much individual training as is feasible locally. For example, where specific perceptual processes involving auditory, visual, or visual-motor impairments have been isolated, training designed to help the child reduce the effects of his specific disability should be instituted. However, when a child receives some of his education in a regular classroom, the classroom teacher should be asked to emphasize his best-functioning capacities. If all his education is provided by a special class for learning disabilities, training to reduce the impairment as well as teaching to the child's perceptual strength (a dual approach) can be the model.

The dual approach should be used, however, only when the child has sufficient intellectual capacity to encompass both assistance and correction without confusion.

Younger children often show perceptual handicaps because they could not master such dual or multidimensional approaches in the regular classroom. The child who has demonstrated a lifelong language problem with marked perceptual handicaps due to central nervous system dysfunction benefits most from specific perceptual training (Eisenson, 1966). But, whatever approach is used, the child must receive the personal satisfaction that comes with success during these crucial years.

Where many children, mainly children below nine years of age, present similar handicaps, group approaches may prove most effective, since children frequently learn best from other children and are more easily motivated within groups. A school might, for example, develop class activity in auditory training for a group of children who all show inadequate auditory discrimination to be at the root of their learning problem. Group rather than individual training also has been found beneficial in certain perceptual motor problems (Frostig & Horne, 1964; Kephart, 1963).

For the child above nine years of age, intervention will need to be thought of largely as compensatory rather than corrective. Where perceptual problems of discrimination, memory, sequencing, closure, or spatial orientation still exist, direct remediation is unlikely to be effective, since basic processing ability is by this age as developed as it ever will be. Guidance and concentrated effort directed at assisting the child to utilize his best skills and substitute them for undeveloped or inadequate skills is essential. For example, if a child at twelve years still shows inadequate auditory perception, the teacher probably should concentrate on helping him use his visual skills. For children above nine years of age the instruction usually must be individualized. It must be directly designed to meet the individual's present needs, even though the problem involved may have originated in an earlier period, when the perceptual handicaps were directly related to learning. The educational demands on older children are such that in almost every instance attempts to reduce the perceptual handicap are likely to produce further failure and to reduce motivation for learning.

Early identification as well as timely intervention is most important, since corrective and compensatory education become more and more difficult with age. Screening children in the very early school years can often help avoid later problems which are more difficult to correct not only because of the specific perceptual problems involved but also because of the many psychological concomitants that can magnify the problems of the child and his special teachers. Very often these may need to be reduced before successful special education can be undertaken.

Although much research is still needed in the area of intervention, successful techniques have been developed (Goldiamond & Dyrud, 1966), and new knowledge about the problems of the child with a specific learning handicap are being constantly reported in the professional literature.

PUBLIC POLICY ISSUES

Every child classified without the cooperative agreement and understanding of his parents should have all the protection necessary to maintain his rights. A review board should act as a board of appeal and explanation for parents who question the classification.

The state should be responsible for establishing guidelines and criteria for approving both the examiners and the teachers of the learning-disabled. It should monitor the work done. It should distribute to the school systems the monies available for special training on a per capita basis. Supervision and assistance must be provided for any community that seeks to establish a learning-disabilities program.

The federal government, through the state boards of education, should allocate funds for support of the additional intervention essential for the training of teachers and for the special education of the learning-disabled child. It should further be responsible for organized research efforts designed to explore further the validity of this concept of learning disability. A further federal responsibility should be monitoring of the state programs, to continue to obtain federal funds, the states must show that they are maintaining the quality of work being done. Where research is needed but not presently forthcoming from any research and development area in the field, such research should be contracted to increase the knowledge base which today is lacking.

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> "The child's ability to discriminate, segment and combine the units of structure in oral language transfers to his dealing with written language."
>
> E. J. Gibson
> The Ontogeny of Reading
> The American Psychologist,
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Chapter VIII- Illustrative Case Histories

Background

Age norms for children 5, 6, 7 and 8 years of age on the Perceptual Test Battery having been established on unselected school populations a method is at hand for diagnostic and prescriptive analysis of individual children. The procedure involved, it is suggested, should be in two stages, first, by differential diagnosis determine whether the child is primarily a learning problem, and second, if he is not, determine his perceptual strengths and weaknesses.

In stage one--the examiner should explore (a) the intellectual capacity through the use of standardized psychometric instruments. Where comprehension and use of spoken language is not in question a full scale battery such as the Wechsler Intelligence Test for Children (WISC-R) should be used. When verbal behavior, however, appears to present a problem (verbal IQ 20 or more points below performance IQ), the examiner should explore intellectual potential by use of either the performance subscales of the WISC-R or by such nonverbal tests as the Colored Progressive Matrices. (Ravens, 1962)

When the response pattern of the subject on the intelligence tests seem grossly inapplicable or the nonverbal behavior inappropriate to the overall impression of the child projective tests such as the Rorschach and/or the Thematic Apperception Test should be used. Again, if verbal behavior is limited such projective tests as the Draw-A-Person (DAP), House-Tree-Person (HTP), or Kinetic Family Drawings (KFD) may provide useful information on the emotional status of the subject.

During this initial stage of differential diagnosis the examiner should be alert to peripheral abnormalities such as deafness or severe hearing loss, visual inadequacy uncorrected or muscular paralysis. Where any or all of these impairments to reception or expression are observed, appropriate medical referrals should be made to assess the extent of the handicap on learning.

Children with such handicaps may or may not have perceptual disabilities which are not available to scrutiny by exploration of perceptual processing. They should be considered as primary learning problems--not learning disabilities. The latter classification made by an analysis of the perceptual processes constitutes stage two of the diagnostic process.

Where the primary problem is found to be due to severe emotional disturbances such as 'schizophrenia' or its even more serious manifestation 'autism', the initial approach in intervention should be psychotherapeutic.

Where generalized and extensive mental retardation is found, educational intervention designed to maximize the limited potential should be the form of attention given.

Where peripheral visual, auditory or muscular disabilities are disclosed, these hazards to education should be appropriately treated by medical referrals.

Where the initial examination and the history indicates a generalized lack of environmental opportunity, such as is frequently seen in the inner cities of large urban communities or in foreign language speaking homes producing a bilingual problem comparison with white middle class normative standards of all test protocols should be treated with extreme caution.

Where any such negative conclusions are established appropriate medical, psychiatric or social service assistance should be sought. This decision (verified by consultation with specialists having appropriate professional credentials)for appropriate treatment should be thoroughly discussed with the child's parents and teachers.

In any case, however, the second stage of examination that of perceptual development should be undertaken. It is readily apparent that the visual perceptual abilities of the deaf should be explored to provide his teachers with evidence of the need for directed auditory and tactile-kinesthetic compensatory training. Where the visual pathway is occluded, as in the blind or partially-sighted child, the auditory and tactile kinesthetic perceptual abilities may materially assist the child's teacher and parents in proper education and guidance.

Even where severe emotional disturbances are found as in the psychotic child, it has proven to be of value to explore where possible the perceptual abilities. Both teachers and counselors of such children will benefit from knowledge of the child's modality preference or perceptual strengths and weaknesses as they work with such children toward an educational as well as therapeutic goals.

Where educational opportunity is found to be lacking co-operation with community social service agencies as well as specialized bi-lingual educational opportunities may need to be sought. If the examiner can provide some suggestive directions through exposing preferential modality or specific perceptual strengths and weaknesses may be of tremendous assistance in maximizing the child's potential.

Where all of the primary learning problems have been ruled out by differential diagnosis and the child recognized as an underachiever because of a specific learning disability, the determination of the specificity of the perceptual processing ability is most important. The level of perceptual adequacy indicates the readiness of the child for formal substantive instruction. Relatively wide developmental differences often appear at this critical juncture.

In one school system for example, it was noted that a roughly equal proportion of children entering the first grade were sufficiently different from their peers in learning typology that depending on their individual idiosyncratic modality preference, they were unprepared formal instruction either because they were so strongly audile or visile that an educational approach directed toward their least preferred modality left them educationally defenseless, despite adequate intellectual ability or motivation.

Through an analysis of perceptual readiness certain of these children would fall into the category of being high risks for becoming learning disabled.

Research in these readiness factors demonstrated the continued progression development to continue through the first eight years of life. Since most educational systems begin formal instruction at roughly the sixth year, it meant that these children were being forced into a learning situation for which they were unprepared.

The picture of educational failure to succeed can be foreseen as even more important when the popular demand for formal instruction is moved into the preschool years. It is true that some children, those with high intelligence and motivation coupled with early perceptual development, can and do learn to read and even write before they reach school age. The educational system is in fact geared to support and re-inforce such children. It is, however, unfortunately true that a majority of children are not so endowed. Educational approaches to these children needs to establish that these less prepared children not suffer because of the success of the chosen few.

The following case histories indicate by example the type of examination, diagnosis and recommendations that can be made from an exploration in depth of a child's problem.

Specific Case Histories

Case 1 -- An illustration of a 'high-risk' child.

Developmental History

Subject is an only male child whose birthdate placed him at six years and two months of age on admission to the first grade. His history indicated no unusual or potentially contributing medical or developmental problems. He was born at full term, had crawled at six months, stood alone at nine months, walked unaided at one year. He began to speak at about the same time but his speech efforts were unintelligible until he reached his third birthday. It was noted by his parents that while he could not be understood he continued to attempt speech and spoke his own jargon with a melody that made it appear that he was attempting to communicate. He made his needs known by gestures, facial grimaces and by pointing to the desired object. By three years of age intelligible words began to appear in his jargon and by four years of age most of his speech conveyed meaning, at least to his mother.

His worried parents reacting to the pressure of their parents and their neighbors had had him examined by a) his pediatrician, who found him alert, inquisitive, responsive to sound, and motorically adequate; and by b) a local speech and hearing clinic who found him deficient only in speech. They advised speech therapy and placement in a pre-school for that purpose. He attended one school daily but successfully interacted only in nonverbal play activities. He was entered into public school kindergarten at 5 years of age. He performed adequately the group activities that were nonverbal in nature but appeared disinterested and withdrawn whenever verbal interchange was required. Because he was a 'nice boy', active in putting puzzles together and socially pleasant, he was entered into the first grade with his age group. His teacher recognized the inadequacy of his language development and the inaccuracy of his articulation and advised further study of his verbal efforts.

Since the school used a phonic approach to reading his inability to learn the phonic/phonetic equivalence to the alphabet, he was characterized as a slow learning child of good intelligence and stable personality (he never caused trouble, had temper tantrums or excessive absence). He was seen as a passive, intelligent child who needed individual attention. The teacher provided this in her spare time exposing him to individual instruction in reading via phonic elaboration. Because he was adept at physically demanding tasks and no trouble in the classroom, this was the extent of the individual instruction provided. But continued failure to acquire a mastery over the letter-sound equivalence and his continued misarticulation plus his parental concern and consequent pressure on both the teacher and the child caused her to refer him to the school's Special Education Department.

Here the examination revealed adequate vision and hearing by the school nurse, i.e., he passed the visual and auditory screening tests with some minor difficulty in the hearing group test but not enough to warrant further auditory examination.

An intelligence test revealed a somewhat lower verbal score than performance ability--some twenty-five points separated his verbal IQ from his nonverbal IQ (90 vs. 117) an unusual distribution indicative of a failure to grasp language cues or to learn verbal symbolic material compensated for by his above average performance on nonverbal abilities.

A reading readiness test showed an adequate visuo-motor ability (since the test required no verbal behavior his inadequacy in that area was not revealed).

A study of his perceptual ability revealed the following protocol.(Profile 1)

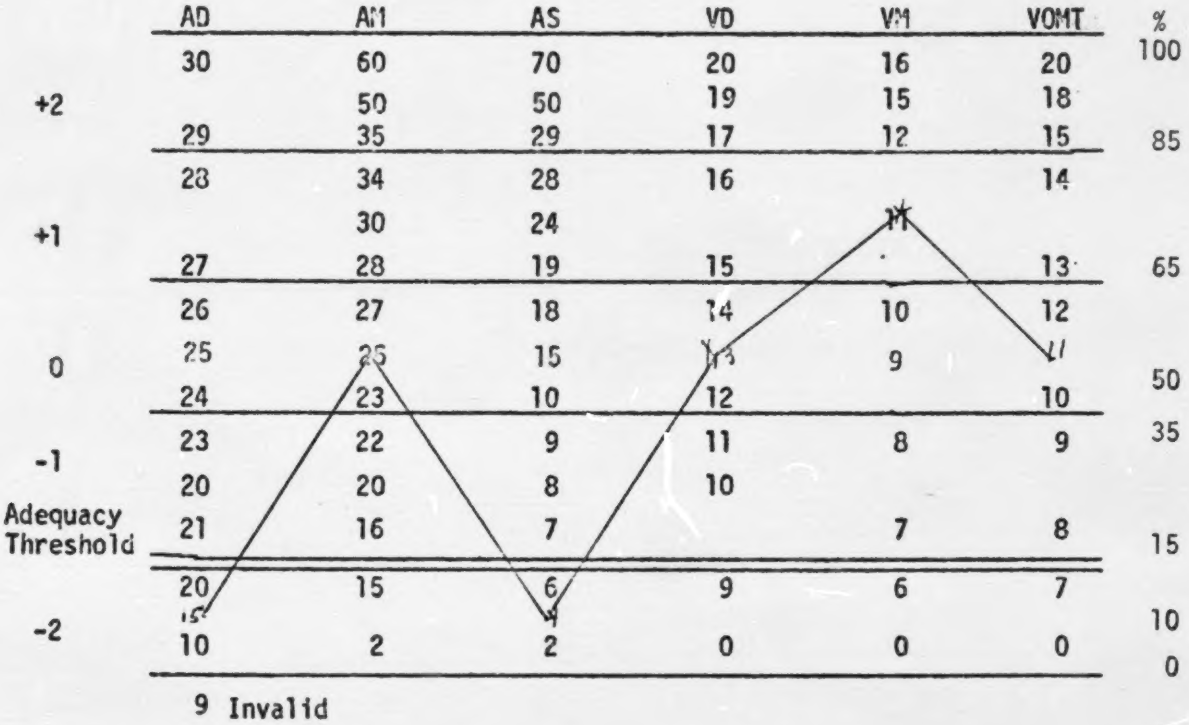
Profile 1

PERCEPTUAL TEST BATTERY
6 Year Old Profile

Name Case #1

Date

Age 6



	AD	AM	AS	VD	VM	VOMT	%
	30	60	70	20	16	20	100
+2		50	50	19	15	18	
	29	35	29	17	12	15	85
	28	34	28	16		14	
+1		30	24		11		
	27	28	19	15		13	65
	26	27	18	14	10	12	
0	25	25	15	13	9	11	
	24	23	10	12		10	50
	23	22	9	11	8	9	35
-1	20	20	8	10			
Adequacy Threshold	21	16	7		7	8	15
	20	15	6	9	6	7	
	15		4				10
-2	10	2	2	0	0	0	
							0
	9 Invalid						

AD scores below 10 invalidates the test. SAME score of less than 7 also invalidates test.

ANALYSIS BY %ile only:

	%		%
Auditory Discrimination	10	Visual Discrimination	50
Auditory Memory	50	Visual Memory	75
Auditory Sequential	10	Visual Orientation	50
Auditory Total	70/3 = 23%	Visual Total	175/3 = 58.5%

Behavior noted as passive -- Cooperation excellent.

Interpretation

1) Good visual perceptual ability

2) Poor auditory development. Inadequate discrimination. Barely adequate auditory memory; inadequate sequencing.

Speech attempts -- poor

Recommendation

A 6-year old child of normal intelligence, good personality, well-motivated with a specific strength in visual ability, major weakness requiring attention in all auditory factors. Specific intervention was recommended in auditory training. Attempts to teach reading should be visually oriented. Not ready for phonics. Intelligence adequate, but not sufficiently superior to indicate the likelihood of a self-adapting compensation. Since his age is only 6 years and 2 months, further auditory perceptual development can be expected. Advice--speech and auditory training, visual emphasis in reading.

Re-examine in six months period if no increase in audition is noted by 7 years of age---continued failure can be expected in phonic approach to reading.

This subject is a high risk child for becoming a learning disability--especially if the school is unable (or unwilling) to consider a strongly emphasized visual program for his beginning learning.

Case 2 -- A 'high-risk' child.

Developmental History

A 5 year, 6 month old boy who has been in kindergarten for seven months. The school raised the question with his parents whether or not he should be promoted to the first grade or retained in kindergarten for another year. The referral letter indicated a general incapacity to participate constructively in group learning experiences. A study by the special education service of the school indicated an overall intelligence test score at a borderline level (group test) approximating an IQ of 80. No behavior abnormalities were noted other than the noted lack of participation and consequent failure to acquire a working knowledge of the alphabet (a requirement of all children), some moderate articulatory inaccuracies, especially with the fricatives and sibilant sounds which were distorted but not omitted.

The child's parents reported a history of general delay in development (i.e., slower than his three older sibs in crawling (9 months), walking 1 year, 3 months; beginning speech unintelligible until 2 years and only slowly developing use of language formed two and three word expressions at 3½ years but always difficult to understand by anyone outside of the immediate family. Most behavior clumsy. On the positive side he showed some aptitude in playing with puzzles, was almost always a quiet child who rarely cried; showed marked attachment to his mother (who in the clinical situation infantilized him).

No visual or hearing problems were reported by the school nurse. The overall school classification was mild retardation; no behavior problem; active participation in physical playground activities; a follower rather than a leader. Recommendation: Retain in kindergarten.

Examination revealed a passive dependent, pleasant and co-operative child. For testing he separated from his mother with some difficulty. A full scale Wechsler Preschool and Primary Scale of Intelligence (WPPSI) indicated a relatively undistinguished scatter of subtest scores ranging from an average of 7 (standard score) on verbal subscales to an average of 8+ on performance subscales. The total IQ confirmed the school impression of borderline ability. The information, vocabulary and arithmetic subscales were his lowest scores (5), while his comprehension and similarity subscales were at a somewhat higher level (7). On the nonverbal subscales his coding score was lowest (5), while his picture completion and block design were at his higher level (8 and 9 respectively).

Examination of his speech (Dual Modality Articulation Test, Morency, 1962) showed the previously noted articulatory inaccuracies. Both fricatives and sibilants which were distorted on auditory stimulation showed less inaccuracy when tested visually.

A Metropolitan Reading Readiness Test was somewhat better than expected showing some rather good figure ground relationships and motor facility (untimed).

A visual and auditory examination revealed no acuity problems. A general medical examination revealed no problems. A Bender-Gestalt Visuo-Motor Test administered as a memory test showed some distortions and rotations but rather adequate recall. When administered as a copying test similar developmental distortions appeared but showed no indication of an organic impairment.

See Profile 2 - p.99

Interpretation

1) No explicit modality preference

   $A_1 = -4$; $V_T = -4$; $A\% = 25$ $V\% = 27.5$

   Slightly better visually than auditorially.

2) A generalized perceptual inadequacy not out of keeping with mild retardation and/or immaturity.

3) A notable relative strength, however, seen in both auditory and visual memory.

Profile 2

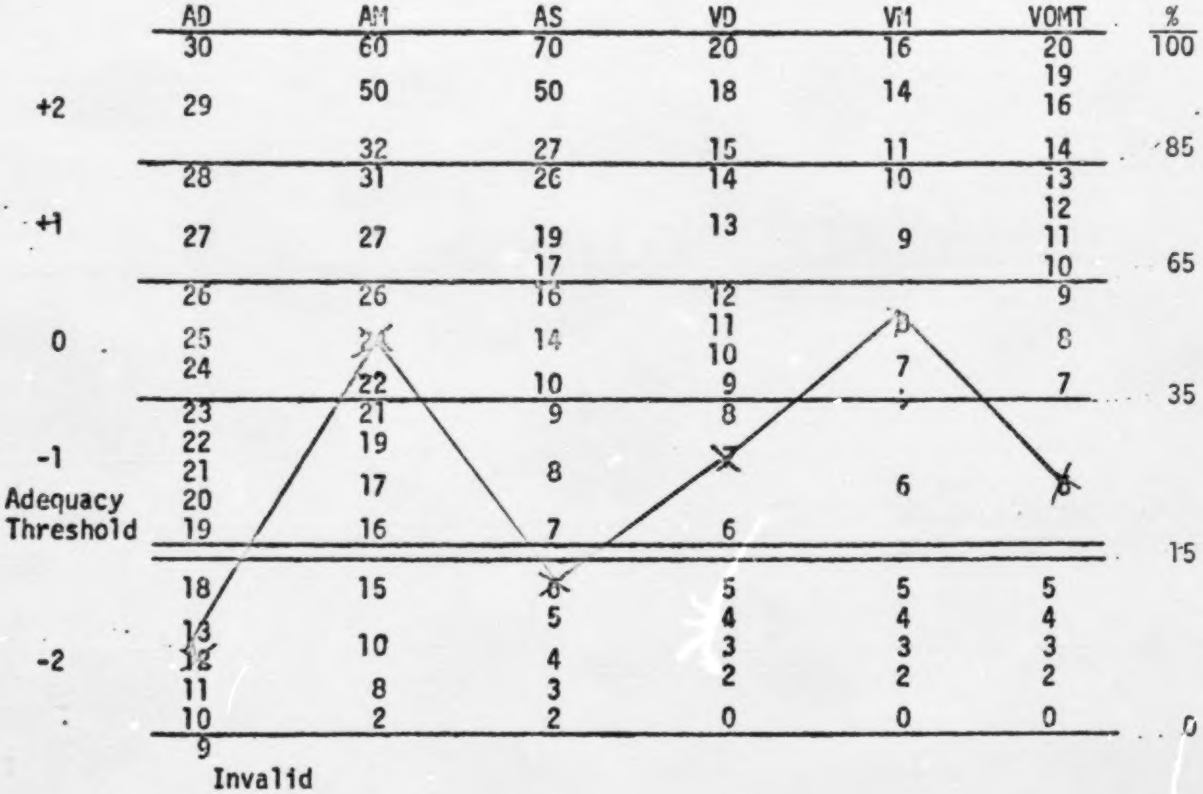
PERCEPTUAL TEST BATTERY

5 Year Old Profile

Name Case #2

Date

Age 5



	AD	AM	AS	VD	VM	VOMT	%
	30	60	70	20	16	20	100
						19	
		50	50	18	14		
+2	29					16	
		32	27	15	11	14	85
	28	31	26	14	10	13	
						12	
+1				13			
	27	27	19		9	11	
			17			10	65
	26	26	16	12		9	
				11	8		
0	25	24	14			8	
				10			
	24				7		
		22	10	9		7	35
	23	21	9	8			
	22	19					
-1							
	21		8				
		17			6		
Adequacy Threshold	20						
	19	16	7	6			
							15
	18	15	6	5	5	5	
			5	4	4	4	
	13						
		10		3	3	3	
-2	12		4				
				2	2	2	
	11	8	3				
	10	2	2	0	0	0	0
	9						

Invalid

AD scores below 10 invalidate the test. SAME score of less than 7 also invalidates test.

ANALYSIS by scaled score only.

	Raw Score	Scaled Score
Auditory Discrimination	12	-2
Auditory Memory	24	0
Auditory Sequential	6	-2
Auditory total	=	-4

	Raw Score	Scaled Score
Visual Discrimination	7	-1
Visual Memory	8	0
Visual Orientation		-1
Visual total	=	-2

General Impression

A generalized slow development in perceptual processing in an infantilized, passive-dependent child whose parents have tended to accept as immature and generally treated him in an infantile manner. The school impression of mild 'intellectual' impairment in an immature child requiring further pre-school experience probably in a class for the educable mentally handicapped if he is to be promoted with his age group appears to be confirmed. However, it should be noted that his strength lies in his improved memory over his other developmental perceptual abilities. Such memory strengths are atypical of the mentally retarded. It is suggested from the personality picture, which indicates considerable stability, that he may be simply delayed in development and not retarded. Many such children show marked perceptual gains in their sixth, seventh and eighth years. The positive nature of his memory capacities indicates that this may be the case.

Recommendation

Promotion to first grade with counseling for the parents to reduce the infantilization. Attention paid to his perceptual development building on his memory facility. Re-evaluation in six months to gauge changes that might occur. Placement in EMH not a preferred choice unless further evaluations show continued lack of development. (The tendency to isolate such children too early in their educational careers often result in permanent separation from age peers--such placement tends to stigmatize the children and makes it difficult for the child to ever take his place with his age peers. If necessary the placement can be made a year later.) Repetition of kindergarten is not advised. Failure to promote would mean that he would be well past his seventh birthday when he entered first grade. Socially, this might well provide the basis for self-denigration and continued failure.

Case 3 -- A 'slow developing' child

Developmental History

An apparently alert child of seven years of age whose history is negative for any primary emotional or physical problems. In personality, he appears well-poised, active and inquisitive. His intelligence is measurably within normal range (WISC IQ's - Verbal 93; Nonverbal 104 = Total 97). The referral complaint did not indicate a behavioral problem. This was confirmed by projective test analysis of a nonverbal nature (the Draw-a-Person, House-Tree-Person and Kinetic Family Tests). The chief referral complaint was his failure to learn to read. Examination ruled out both visual and auditory peripheral acuity problems.

See Profile 3 - p.102

It is evident from the profile, scaled score total and percentile total that the child is moderately better in visual perceptual development than in auditory processing ability. The scaled score ratio of -3.0 and percentile difference of V_T = 48% vs A_T % of 28 indicate this moderately preferred visual modality preference.

The very low auditory discrimination points to the potential for marked difficulty in a phonic approach to learning to read. In general, the specific disability in auditory perception supports the general developmental auditory inadequacy and its consequent likely effect on a phonic approach to learning to read or write. The lower visual reflection test result indicates an as yet lack of readiness for externalization in cognitive functions.

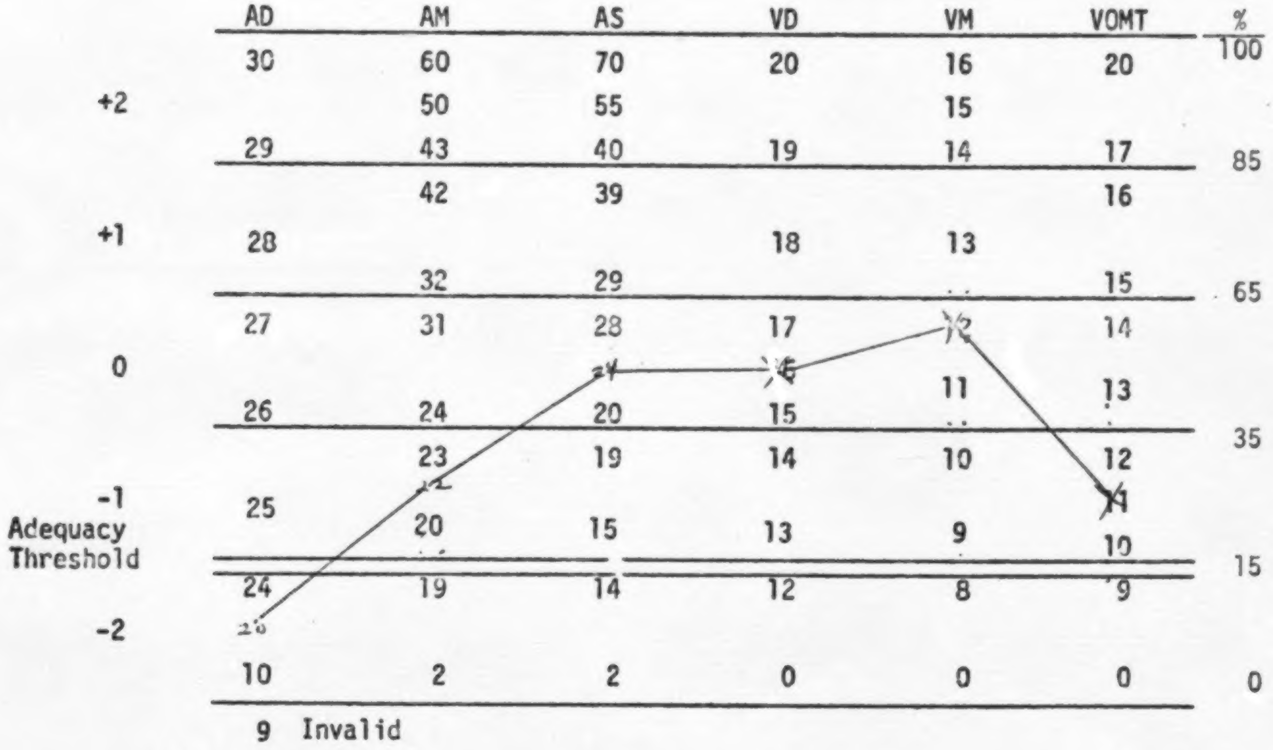
Profile 3

PERCEPTUAL TEST BATTERY
7 Year Old Profile

Name Case #3

Date

Age 7



	AD	AM	AS	VD	VM	VOMT	%
	30	60	70	20	16	20	100
+2		50	55		15		
	29	43	40	19	14	17	85
		42	39			16	
+1	28			18	13		
		32	29			15	65
	27	31	28	17		14	
0					11	13	
	26	24	20	15			35
		23	19	14	10	12	
-1	25						
Adequacy Threshold		20	15	13	9	10	15
	24	19	14	12	8	9	
-2							
	10	2	2	0	0	0	0
	9 Invalid						

AD scores below 10 invalidates the test. SAME score of less than 7 also invalidates test.

Analysis by scaled score and percentile.

	Raw Score	Scaled Score	%
Auditory Discrimination	20	-2	10
Auditory Memory	22	-1	25
Auditory Sequential	24	0	50
Auditory total	=	-3	85/3=28%

	Raw Score	Scaled Score	%
Visual Discrimination	16	0	50
Visual Memory	12	0	65
Visual Orientation	11	-1	25
Visual total	=	-1	140/3=38.5%

Recommendation

1) Concentration on visual learning whole word approach
2) Training in auditory processing
3) Training in right-left directionality relations of self to the world and perhaps attempts to develop psychologically, since the low visual reflection ability often indicates immaturity.
4) Re-evaluation of perceptual abilities in one year to be certain that the difficulty shown is not a simple lag in development due to failure and consequent secondary emotional problems.
5) Discussion with parents and teachers indicating need to understand subjects difficulty with auditory perception including discrimination and memory. The latter may be provoking life situations causing further frustration such as inability to understand or recall verbal messages or instructions.

Case 4 -- A 'persistent underachieving' child.

Developmental History

A somewhat hyperactive, fidgety child of twelve in the 5th grade in school. The medical and developmental history is non-contributing other than the fact that astigmatism was noted at age three and the subject has consistently worn glasses to correct her visual acuity defect. The subject has 20/20 vision with correction

Chief school (and parental) complaint is a failure to learn anything but the rudiments of reading, writing, spelling or arithmetic. Behavior in school is sometimes disruptive, considerable hostility is expressed when subject is held to particular educational tasks. Many absences are noted in the attendance record.

Examination revealed a bright, normal intelligence test record (WISC V IQ = 120; P IQ = 100; Full IQ = 115). Analysis of the subscales of the WISC showed no marked deviations other than a scaled score of 6 in coding. His relatively lower performance scores were notably due to a failure to earn time credits--in general his intellectual capacity was depressed by this inability to respond rapidly.

A Bender-Gestalt Visuo-Motor Test protocol revealed a developmental lag in performance with a 'Koppitz' score equal to an 8-year old expectancy. His form production showed inadequate size, some regression of circles to dots but no motor inadequacy. Again, a slower than average production time was noted. No indication of brain impairment was seen nor any overt signs of anxiety. Non-verbal projective tests (Draw-a-Person, House-Tree-Person, and Kinetic Family) showed a tendency toward regression and some inadequacy in form but notably no indication of a lack of affect nor overreaction to stress. In every instance, however, his figures were small and inaccurate in proportion. The Kinetic Family showed a strong identification with his father and a relegation of his sisters (three older female sibs) to a subsidiary role in the family.

His verbal proficiency was (WISC V IQ = 120) evidence on the Thematic Apperception Test but meagre in content, again, the strong all powerful father figure dominated his subconscious fantasy.

The results of his perceptual problem were evident on his perceptual test battery performance.

See Profile 4 - p.105

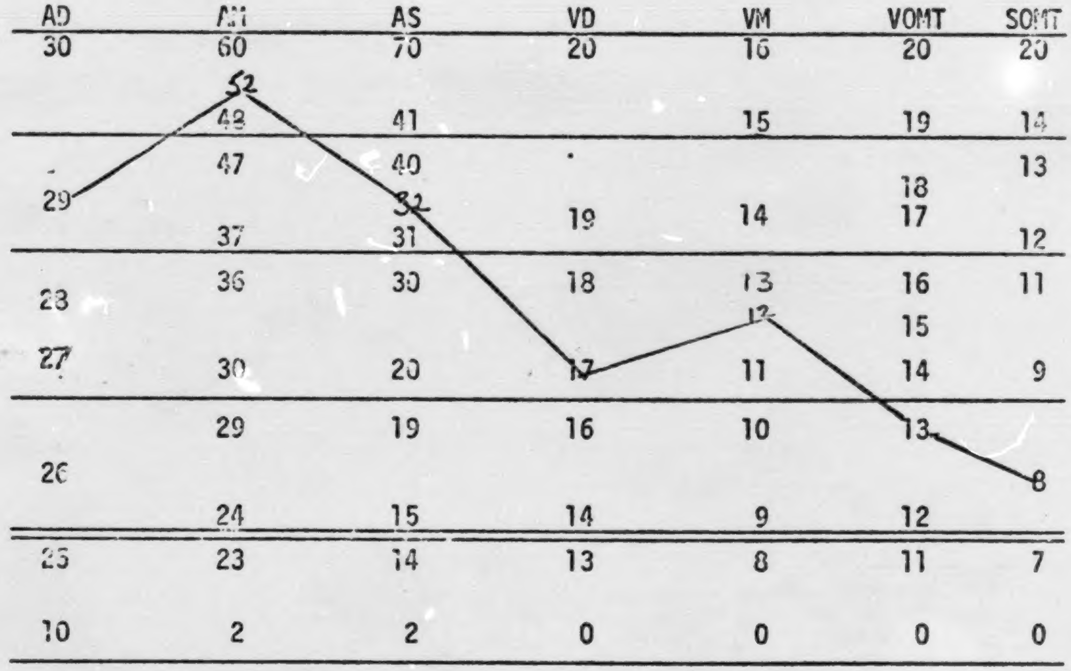
The test revealed a strong auditory preference over a lower visual modality ability.

Profile 4

PERCEPTUAL TEST BATTERY

8 Year Old Profile

Name Case #4
Date
Age 12



Scaled Score	AD	AM	AS	VD	VM	VOMT	SOMT	%
	30	60	70	20	16	20	20	100
		52						
+2		48	41		15	19	14	85
	-	47	40	•		18	13	
+1	29		32	19	14	17		
		37	31				12	65
	28	36	30	18	13	16	11	
					12	15		50
0	27	30	20	17	11	14	9	35
		29	19	16	10	13		
-1	26						8	
Adequacy Threshold		24	15	14	9	12		15
	25	23	14	13	8	11	7	
-2	10	2	2	0	0	0	0	

9 Invalid

AD scores below 10 invalidates the test. SAME score of less than 7 also invalidates test.

ANALYSIS:

	Scaled Score	%		Scaled Score	%
Auditory Discrimination	+1	75	Visual Discrimination	0	35
Auditory Memory	+2	90	Visual Memory	0	50
Auditory Sequential	+1	75	Spatial Orientation	-1	25
Auditory total	+4	or 80%	Visual total	-1	or 37.5%

Analysis by both scaled score and percentile.

*when age of child is below 8, VOMT is used -- 8 or above, SOMT is used.

The Perceptual Test Battery in general confirmed the perceptual handicap. The higher auditory scores were in keeping with the higher verbal IQ (WISC V IQ= 120) and the noted verbal fluency on the Thematic Apperception Test. While the generally average visual capacity agreed with the form inadequacy on the Bender Gestalt Visuo-Motor Test.

A Reading Achievement Test (Wide Range Achievement Test) revealed a halting, non-fluent reading ability approximately at the second grade level. A word-by-word phonic analysis of new words showed his reading to be largely imitative with many errors in comprehension.

The difficulty in reading was accompanied by an equal difficulty in spelling (most of his attempts were phonetic substitutions). The bright-normal intellectual ability indicated a potential for improvement with directed intervention capitalizing on the phonic capacity. It was felt that the overt hyperactive behavior was reactive to the failure to learn rather than the cause of his difficulty. The strong sexual identification with the father whose career was technical and largely non-academic (his father had dropped out of school at the 10th grade level to work). His mother who had finished high school was the disturbed parent concerned about the boy's failure since her goals for him included a college education.

Recommendations

1) Counseling to attempt to change the attitude toward learning.
2) Educational intervention stressing auditory compensation for the visual weaknesses.
3) Parent and teacher conferences on effect of the child's perceptual handicap and expectation for improvement with compensatory guidance.

Chapter IX -- Discussion Method and Intervention Implications

A developmental concept of how children learn has been presented. It is based on certain rational assumptions and what is known about the neurophysiological maturation of children during their formative years up to the age of nine. It takes into account the child's genetic endowment and the salient effects of environmental conditioning at each step or stage of their cognitive development. It supplies a method by which teachers can gain a more complete understanding of both the common and unique characteristics of each child which can be utilized in providing rewarding educational guidance and support as the child adapts to the final and culminating stage of his learning--as he learns-to-learn.

The schematic model of the developmental hierarchy of learning (pg.   Chap. is perhaps more readily understood if one pictures a series of independently developing but constantly converging lines. As these lines converge, the interact more and more--each line's maturation effecting each other line through the matrix of immediate memory and thereby enhancing the maturational pattern.

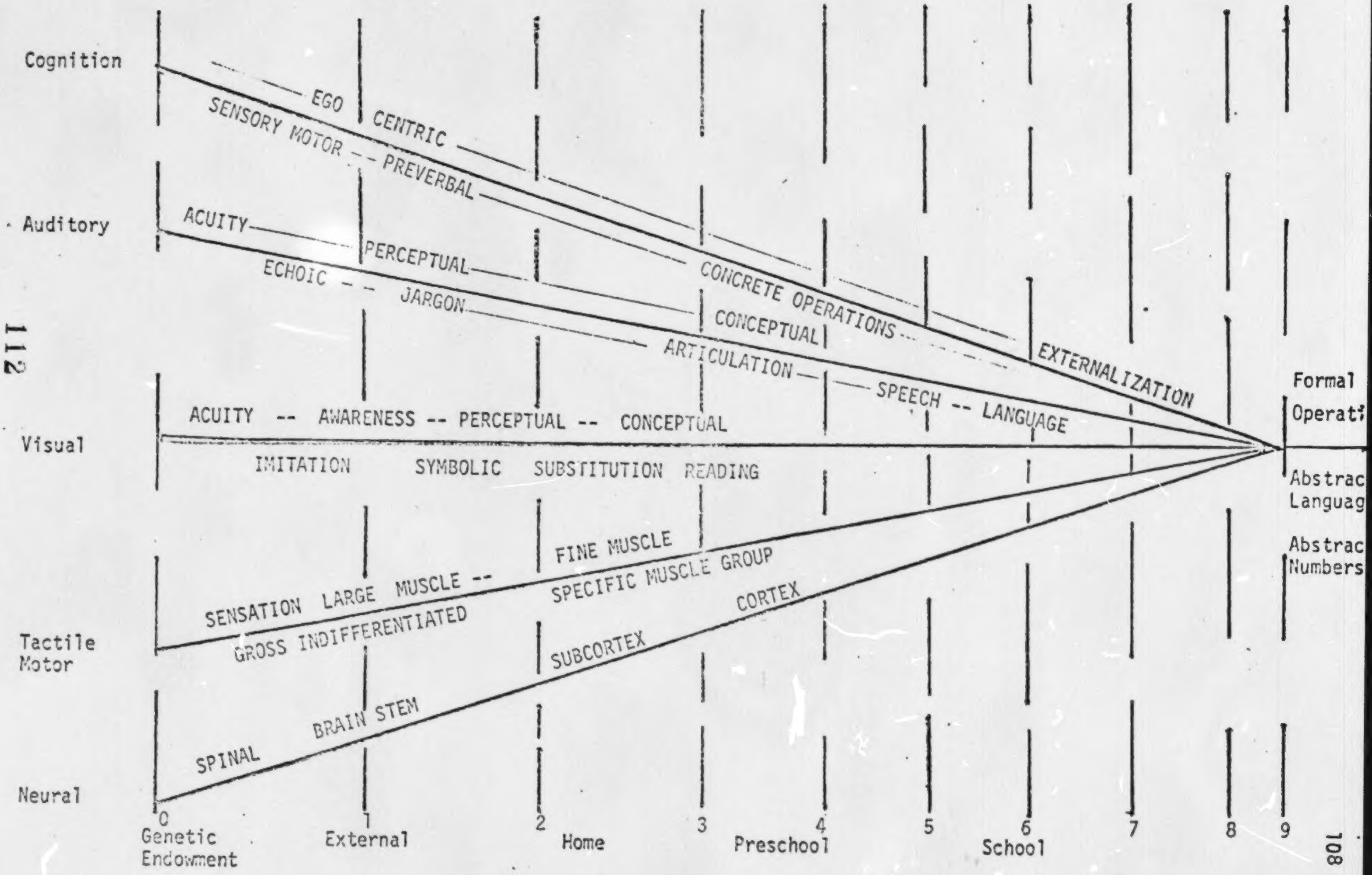
Figure 2 goes here

The hierarchy of interlocking processes from the genetic endowment at birth through the critical formative years exemplifies the ontogentic likenesses between people but also indicates the potential for individual differences. During a child's very early years the innate capacity and structure is most evident. With time, opportunity, experience and stimulation the effect of environmental conditioning becomes more apparent.

FIGURE 2

Independent Converging Pathways: Interaction through memory

Short term memory - Long term memory - Increased Interaction


Cognition
Auditory
Visual
Tactile Motor
Neural
EGO CENTRIC
SENSORY MOTOR -- PREVERBAL
CONCRETE OPERATIONS
EXTERNALIZATION
ACUITY
PERCEPTUAL
CONCEPTUAL
ECHOIC -- JARGON
ARTICULATION
SPEECH -- LANGUAGE
ACUITY -- AWARENESS -- PERCEPTUAL -- CONCEPTUAL
IMITATION SYMBOLIC SUBSTITUTION READING
SENSATION LARGE MUSCLE --
FINE MUSCLE
GROSS INDIFFERENTIATED
SPECIFIC MUSCLE GROUP
SPINAL
BRAIN STEM
SUBCORTEX
CORTEX
Formal Operati
Abstrac Languag
Abstrac Numbers
0 Genetic Endowment
1 External
2 Home
3
4 Preschool
5
6 School
7
8
9

It is at the pre-school and early school level that intervention becomes a salient factor.

Implied but not apparent perhaps in Figure 2 is the increasing degree of interaction as the child approaches the stage of formal operation--of abstract thought and language. Figure 2 presents schematically five major lines of development during the vital critical periods of maturation. It shows the independence of each as the child matures and the interrelation between the different characteristics through the process of memory. While each of the lines are capable of wholly independent and individually unique rates of development, their interdependence for full utilization is apparent.

The origin of each line is seen to be in the genetic endowment with the environment playing an increasing role as time ensues. Each line begins as a gross, roughly undifferentiated characteristic and progresses both through an extension of innate capacity and environmental opportunity and conditioning.

No exact chronological time table mirrors the development--wide variations occur both because of differential endowment and the variable forces of the environment.

Of the five concurrently developing processes the neurological (which also includes the neuroanatomical) is probably the most absolute in its development. The increasing capacity of the neural structure from spinal reflex, through brain stem function to the highest level of subcortex and cortex indicates clearly the potential limitations placed on the development of other pathways when impairment occurs. Any interruption due to pathological or developmental factors will create a reduction in the adequacy of development of all of the other lines. A birth defect, for example, effecting neurological maturation will show not only as a reduction in the complexity of neural activity, but have a negative effect upon the development of cognition, perceptual processing and motor coordination.

This is less true of the other lines of development. Perceptual processing--the subliminal learning via the different modalities may show lags in developmental rate yet cognition--the conceptual pathway related to thought process development and meaningful reception and reaction may be effected only in the sense of adequacy of verbal expression.

Most importantly in studying the child it is vital to recognize the interaction of the various vectors through the process of retention and recall.

Each of the developmental lines may and most often are studied separately, yet no true picture of a child's capcity at any time in his maturation can be obtained if the particular line of development is not considered in the light of the stage of development of the other vectors. Cognition, for example, depends upon perceptual processing development for efficiency in language formulation and use. Language usage which is often equated with intelligence is wholly dependent on the child learning the phonemic/phonetic patterns making up the code of communication of the society in which he is reared. Equally as the child reaches the stage of orthographic substitution for previously learned phonemic/phonetic patterns--as he learns to read and write--using the linguistic code that has made his speech intelligible, the degree of perceptual visual and auditory processing is the basis of his formulation of graphic verbal symbols. It provides him with the alphabets he needs to formulate intelligible language.

The perceptual processes include the ability to discriminate, to retain and recall the alphabets of phonemes and graphemes, the ability to imitate and to echo the stimuli of visual and auditory signals while not totally or irrevocably essential to cognitive development; i.e., the deaf child develops a thought-processing ability without a phonemic/phonetic alphabet. Yet for the most part, the unimpaired child utilizes these lower level functions in bringing his cognitive capacities to their highest level of development.

Independence of development and maturational capacities is a key to individual differences, yet interdependence is the keystone of maximal development. Each child reaches the stage of concrete operations--not all go beyond that stage. However, Goldstein in the early forties (1941) recognized insightfully the effect of brain impairment on the cognitive process. He pointed out that the mode of thought after brain injury was more than a focal disturbance of a specific capacity impaired by cortical trauma but a total regression to a state of concretistic thought from whatever level of abstract thought the individual had achieved.

The model presented in Figure 2 shows no separable line of language development. Language, the comprehension and use of verbal symbols for communication, is without question a higher mental process--through language use the individual child or adult displays in a sense his intellectual capacity, yet, it is at best a poor indicator of thought. It is this writer's observation and belief that language development is the product of all the separate converging lines. It serves man as a means toward an end--societal interaction--yet by its own constraints, the rigidity of its syntactic structure and the automaticity of its production, it serves the individual intellect but is not co-equal with it. Language in this sense is the maidservant of thought, not its mirror. Man can and does survive without language--verbal language cannot and does not exist without man (Furth, 1966).

Briefly, the presented concept of learning holds that each child has a natural genetically determined preferential modality for acquiring information, i.e., that he learns best by ear (audile), by eye (visile), or by touch and movement (tactile) stimulation. The degree of such preference for each modality is determinable by alert observation and by tests designed for that purpose.

The value of knowing this about any child is the potential it provides for individuated guidance and training. The approach which is most likely to be most supportive and reinforcing during this very critical period. Further, it identifies those children whose modality preferences are so unimodal that educational efforts emphasizing one of the other modalities may establish a negative set toward learning. It also establishes the important age at which a given child is ready to learn, or, oppositely, is not ready. Readiness, here, means that the pre-operational and stimulus-response aspects have reached a stage where they can usefully provide the necessary processes for cognitive language comprehension and use.

As the model on page 108 indicates, a hierarchy of learning potential is held to exist building from the innate reflex arc to the subliminally acquired perceptual processing ability which is innately determined but environmentally stimulated, to the higher levels of conceptual thought which within the constraints of the endowed capacity, are the product of human interaction.

This modality bound (at the perceptual level) learning concept holds that there exists an inextricable interdependence of behavior and neurophysiological maturation. The complexity of a child's behavior, it holds, reflects the complexity of the neural growth and use which each modality develops at its own rate as an independent mode of reception and use of stimuli, its integration into the culminating cognitive process is markedly influenced by the interaction between the modalities. It is this independent yet interactive combination that permits the child to utilize all of his varying capacities in the necessary integration for learning. This synthesis of interactive independent lines providing him with the capacity to think, to feel, to solve problems, to relate spontaneously to his environment and make the most of it--to proceed from the concrete to the abstract in his thought processes.

The reflex (inborn stimulus-response) mechanism indicates the unimpaired interaction between specific stimuli and specific response. The perceptual (innately patterned, environmentally conditioned) level reflects subliminal learning of the underlying units for the phonemic and graphemic alphabets of language and thought. Through the imprinting within memory (retention and recall) of these units the wherewithal for communal linguistic verbal behavior are provided. Language behavior expressing the child's thought would be impossible if his system did not acquire these species--common decoding and encoding symbols--even though he may never consciously apply them. It must be noted that as the child moves from being a speaker using the phonemic/phonetic alphabet to guide his utterances to being a reader and writer using the arbitrary and non-equivalent letter alphabet, that he is progressing from a natural concrete process (speaking) to an artificial abstractive process, reading and writing. Certainly one of the more difficult adjustments in all development is this need to constrain a previously acquired articulatory alphabet of sounds (some 40 different sounds are used in English with endless vernacular modifications, both ethnic and geographical) to the restricted and arbitrary printed alphabet of 26 letters. Spoken language is limited only by the muscular co-ordinative capacity of imitating what is heard or what the child's discrimination of the sounds of the language permits him to distinguish. Each child develops his own internal monitoring system for guiding and self-correcting his spoken efforts. Thus, for one child with acute auditory discriminatory ability speech production soon mirrors with intelligible accuracy the speech he hears, while a second child with slower maturation of auditory discrimination and consequently slower developing self-monitoring tends to imitate what he hears inaccurately--he speaks each sound he attempts with an approximation of what he hears--only when his discriminatory power develops sufficiently for a more accurate imitation will the distortions and substitutions disappear from his speech.

Intelligibility of spoken language increases in rather direct proportion to the increase in ability to discriminate. Establishing an adequate and useful monitoring system is dependent on how advanced the child's perceptual recall becomes. Since speech, to be completely accurate, must not only imitate the sounds the child hears but must do so in the order or sequence in which he hears them, these three perceptual processes--Discrimination, Recall and Sequential Order Recall become the basic automatic structure of oral communication.

As reading, writing and spelling using the arbitrary printed alphabet of letters become the learning task the same perceptual processes---discrimination of forms, recall span of forms and recall of their sequential order become the necessary developmentally achieved abilities.

In the model presented, then, for learning to communicate, to comprehend and use intelligible language the full power of cognitive development can only be achieved at the abstractive representational level when the perceptual, stimulus-response, pre-operational processes develop sufficiently to be useful in verbal symbolic formulation and comprehension.

Visual recall has an added perceptual discrimination--not only must forms be discriminated, a sufficient span of letters be recalled in the order of their presentation but they must be recalled in a particular orientation, i.e., they must be recalled in the direction they were pointing since in our arbitrary alphabet of letters direction is often confusing--(parenthetically, this directional recall ability seems closely related to a child's image of himself in relation to others and to objects in the world in which he lives.) The printed form (in English) always proceeds from left to right--there is, however, nothing natural about this directionality. It must be learned. Since some children have difficulty or are slower in developing this capacity, their rate of developing reading may be restricted until the ability develops. Unlike the other necessary perceptual processes which must develop to a state of adequacy prior to their use do so within the first eight years of life--spatial orientation probably because of its relation to other psychological factors as the child's relationship to the world he lives in is often slower to develop. As indicated, this capacity continues to develop in some children through puberty--and in some even later.

Following the concept of differential rates of development of the basic perceptual processes standard levels of achievement at each age 5 through 8 have been developed and by utilizing these standard age related norms, the individual differences of children can be determined. (See Appendix B--Age Profiles)

Learning Disabilities

In these critical years of development the key word that typifies the period is interaction--stimuli are recognized from each modality of reception and interact with other stimuli to provide the matrix of memory. Short term immediate memory is needed for learning sufficient for imitation or echoing behavior while long term memory is memory for speech production in the native language code. Interaction between sensory-motor and pre-verbal operational behavior is the precursor to the development of higher mental processes: to provide the self-correcting monitoring system through feedback from the acts performed. Interaction within memory is necessary for the associations that make up the thought processes.

Learning-to-learn is the process of adaptation that is unique to each individual. Failure to learn is the failure of the necessary interaction due to lags in development or to pathology. Learning disabilities are most simply defined, then within this developmental hierarchy not at the cognitive, conceptual level alone for that simply reflects the failure of development below it in the hierarchy --the learning disabled are those whose cognitive development is impaired by the inadequacy of the perceptual processes which provide its basic structure for expressive language. Learning disabilities are perceptual handicaps revealing themselves in the substantive acts of learning. They may be due to external pressures, such as teaching methods requiring attention, discrimination and/or recall in a mode or to the degree that the child is unable to perform at the time expected of him. As the years go on--and cognitive requirements become more abstract in form as well as more demanding the child who is unable to adapt is often seen as retarded; if he becomes disturbed by his failure, he is seen as emotionally disturbed; if he acts out his feelings, he is seen as a behavior problem.

Modality oriented development functions at both the perceptual and conceptual levels--the latter developing to maturity only as the lower levels of perceptual processing and interaction between the modalities provide sufficient structure and form for the requirements of learning. In addition, concurrent development of coordination providing the capacity for the muscular movements of speech must occur. The purely sensory processes of audition, vision and tactile-kinesthesia coupled with the fine muscle development and coordination produce by their interaction the sensory motor processes discussed so adequately by Frostig (1968) and Ayres (1973).

Educational Implications

The teachers as well as the principal or other school administrator responsible for curriculum and methods of instruction in the early elementary grades should take cognizance of the modality preferences of all of the children studied. This would lead to organization of instruction most suitable for the children and tend to maximize their potential for success. Special attention should be given to these children who appear to be below the level of adequacy for formal instruction at the kindergarten and first grade level. For these children perceptual training should precede formal substantive teaching or such training should be supplemented by experience at the perceptual level. For children at the second or third grade levels who continue to show inadequacies in perceptual processing despite the fact that they have been exposed to one or more years of substantive instruction an effort should be made to adjust their instruction to their best modalities. For example, children of this age who still show inadequate auditory discrimination should have special training in auditory perception probably on a one-to-one basis, but in groups if a sufficient number exist to warrant the hiring of personnel necessary. This might be an area where paraprofessionals might be used under the supervision of the schools regular teacher, the remedial reading teacher or the speech therapist.

In general, educational methods stressing phonics should be avoided whenever a child shows inadequate readiness or development of auditory perception in either of its aspects--discrimination or recall. Oppositely, a phonic approach should be used for those children whose auditory adequacy has been demonstrated.

Where visual perception has been demonstrated as within the adequate range and the auditory perception less adequate a sight training, whole word approach might be indicated as a first step to learning to read with phonics being introduced as adequacy in audition develops. Where both auditory and visual perception shows inadequacy special attention to perceptual training should precede any substantive educational intervention.

The special education section and school administrators should be alerted to those children nine years or older--(above the 3rd grade) who continue to show underachievement related to perceptual handicaps. For most such children compensatory techniques seem indicated. A child who has reached this age without progress in learning to read, write and/or spell should be carefully evaluated for strengths as well as weaknesses of perceptual development. Where specific handicaps are found (example auditory and/or visual memory) with some demonstrable discriminatory ability the suggested training would be mnemonic in nature to attempt to countereffect the deficiency but also should stress the potential for multiple clueing, attention to detail, and the speed of instruction --such compensatory processes may affect the memory problem to some degree.

In many instances such children develop secondary psychological problems because of their failure to achieve as expected. This factor must be considered in any educational intervention. It can sometimes be accomplished by a successful remedial teacher whose empathy and support as well as instruction may serve the psychotherapeutic needs. Where the behavior has become pre-eminent and blocks educational attempts, a counseling, psychotherapeutic relationship may need to be developed prior to any directed educational efforts.

A general caution is advisable, re-labeling the children. In many circumstances such labels as 'retarded', 'emotionally disturbed', 'perceptually handicapped', et cetera are easily affixed but often are impossible to remove from a child's record. Wherever possible the use of such stigmatizing labels should be avoided. In any case before they are used the parents as well as all of the school personnel should be advised of the decision for special education--presented with the evidence and permitted to appeal to other resource for confirming opinions before irrevocable decisions are implemented. The rights of the individual child should be protected. The rights of the parents to have full knowledge of the basis for the decision and the suggested program as the child's guardian should be respected.

The goal of all education at this stage is to assist the child to maximize his potential for learning. It should remain at that level and not be changed to one of substantive achievement.

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APPENDIX A

Standardization and Interpretation Tables

AUDITORY DISCRIMINATION TEST

Standardization and Interpretation Table

Forms IA and IIA

Rating Scale*	Age			
	5	6	7	8
+2	30 29	30 29	30 29	30
+1	28 27	28 27	28	29
0	26 25 24	26 25 24	27 26	28 27
−1 Adequacy	23 22 21 20 19	23 22 21	25	26
Threshold −2	18 17 16 15 14 13 12 11 10	20 19 18 17 16 15 14 13 12 11 10	24 23 22 21 20 19 18 17 16 15 14 13 12 11 10	25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10
INVALID Scores below 10 invalidate the test. **NOTE:** Scores in the SAME column below 7 also invalidate the test.	9 8 7 6 5 4 3 2 1 0	9 8 7 6 5 4 3 2 1 0	9 8 7 6 5 4 3 2 1 0	9 8 7 6 5 4 3 2 1 0 INVALID

*Rating Scale Legend for Interpretation based on cumulative frequencies.

15%	+2	-- indicates a very good development
20%	+1	-- above average ability
30%	0	-- average ability
20%	−1	-- below average discrimination ability
15%	−2	-- below the level of the threshold of adequacy

(Adapted from Manual, published by Language Research Assoc., Inc., 1973)

AUDITORY MEMORY SPAN TEST

STANDARDIZATION AND INTERPRETATION TABLE

Forms I and II

Rating Scale*	AGE			
	5	6	7	8
+2	60			
	59			
	58			
	57	60		
	56	59		
	55	58		
	54	57		
	53	56		
	52	55		
	51	54		
	50	53		
	49	52	60	
	48	51	59	
	47	50	58	
	46	49	57	
	45	48	56	
	44	47	55	60
	43	46	54	59
	42	45	53	58
	41	44	52	57
	40	43	51	56
	39	42	50	55
	38	41	49	54
	37	40	48	53
	36	39	47	52
	35	38	46	51
	34	37	45	50
	33	36	44	49
	32	35	43	48
+1	31	34	42	47
			41	46
		33	40	45
	30		39	44
		32	38	43
	29	31	37	42
			36	41
		30	35	40
	28		34	39
		29	33	38
	27	28	32	37

Rating Scale*	AGE			
	5	6	7	8
0	26	27	31	36
			30	35
	25	26	29	34
			28	
	24	25	27	33
	23	24	26	32
			25	31
	22	23	24	30
−1	21	22	23	29
	20	21		28
		20	22	
	19	19		27
	18	18	21	26
	17	17		25
Adequacy	16	16	20	24
Threshold	15	15	19	23
	14	14	18	22
	13	13	17	21
	12	12	16	
	11	11	15	20
	10	10	14	19
	9	9	13	18
	8	8	12	17
	7	7	11	16
−2	6	6	10	
	5	5	9	15
	4	4	8	14
	2	2	7	13
			6	12
			5	11
			4	10
			2	9
				8
				7
				6
				5
				4
				2

*Rating Scale Legend for Interpretation based on cumulative frequencies

15%	+2	indicates very good development
20%	+1	above average memory span
30%	0	average memory span
20%	−1	below average memory span
15%	−2	below level of threshold of adequacy

(Adapted from Manual, published by Language Research Assoc., Inc.,1973)

AUDITORY SEQUENTIAL MEMORY TEST

Standardization and Interpretation Table
Forms I and II

Rating * Scale	AGE 5	6	7	8
+2		70		
		60		
		59		
		58		
		57		
		56		
		55		
		54		
		53		
		52		
		51		
		50		
		49	70	
		48		70
		47	69	
		46	59	60
		45	58	59
		44	57	58
		43	56	57
		42	55	56
		41	54	55
		40	53	54
		39	52	53
		38	51	52
		37	50	51
		36	49	50
		35	48	49
		34	47	48
		33	46	47
		32	45	46
		31	44	45
		30	43	44
		29	42	43
		28	41	42
		27	40	41
+1	26	28	39	40
	25	27	38	39
	24	26	37	38
	23	25	36	37
	22	24	35	36
	21	23	34	35
	20	22	33	34
	19	21	32	33
	18	20	31	32
	17	19	30	31
			29	
0	16	18	28	30
		17	27	29
	15			28
	14	16	26	27
		15	25	26
	13	14	24	25
		13	23	24
	12			23
		12	22	22
	11	11	21	21
	10	10	20	20
−1	9	9	19	19
			18	18
	8	8	17	17
			16	16
Adequacy	7	7	15	15
Threshold	6	6	14	14
	5	5	13	13
	4	4	12	12
	3	3	11	11
	2	2	10	10
	1	1	9	9
	0	0	8	8
−2			7	7
			6	6
			5	5
			4	4
			3	3
			2	2
			1	1
			0	0

*Legend for Interpretation of Rating Scale:
(based on cumulative frequencies)

15%	+2	indicates a very good development
20%	+1	a positive but not yet fully developed ability
30%	0	an average ability
20%	−1	a moderately low ability indicative of a continuing problem
15%	−2	below the level of the threshold of adequacy

(Adapted from Manual, published by Language Research Assoc.,Inc., 1973)

Visual Form Discrimination Test

Standardization and Interpretation Table

		Age		
Rating Scale*	5	6	7	8
	20	20	20	20
	19			
+2	18	19		
	17	18		
	16			
	15	17	19	
	14	16		
+1				
	13	15	18	19
	12	14	17	18
0	11	13	16	
	10			
	9	12	15	17
	8	11	14	16
-1	7			
Adequacy	6	10	13	14
Threshold	5	9	12	13
	4			
-2	3	6	8	9
	2	3	4	5
	1			
	0	0	0	0

*Rating Scale Legend for Interpretation based on cumulative frequencies.

15%	+2	indicates very good development
20%	+1	above average memory span
30%	0	average memory span
20%	-1	below average memory span
15%	-2	below level of threshold of adequacy

Visual Form Memory Test

Standardization and Interpretation Table

	Age			
Rating Scale*	5	6	7	8
+2	16 14 11	16 15 12	16 15 14	16 15
+1	10 9	11	13	14
0	8 7	10 9	12 11	13 11
-1	6	8 7	10 9	10 9
Adequacy Threshold				
-2	5 4 3 2 0	6 4 0	8 6 0	8 6 0

*Rating Scale Legend for Interpretation based on cumulative frequencies.

15%	+2	indicates very good development
20%	+1	above average memory span
30%	0	average memory span
20%	-1	below average memory span
15%	-2	below level of threshold of adequacy

Visual Orientation Memory Test

Standardization and Interpretation Table

		Age	
Rating Scale*	5	6	7
+2	20	20	20
	19		
		18	
	16		
	14	15	17
+1	13	14	16
	12		
	11		
	10	13	15
0	9	12	14
	8		
	7	10	13
-1		9	12
	6		11
Adequacy		8	10
Threshold	5	7	9
-2	4		
	3	4	6
	2		
	0	0	0

*Rating Scale Legend for Interpretation based on cumulative frequencies.

15%	+2	indicates very good development
20%	+1	above average memory span
30%	0	average memory span
20%	-1	below average memory span
15%	-2	below level of threshold of adequacy

Spatial Orientation Memory Test

Standardization and Interpretation Table

Rating Scale*	Age 8
+2	20 14
+1	13 12
0	11 10 9
-1 Adequacy	8
Threshold -2	7 0

*Rating Scale Legend for Interpretation based on cumulative frequencies.

15%	+2	indicates very good development
20%	+1	above average memory span
30%	0	average memory span
20%	-1	below average memory span
15%	-2	below level of threshold of adequacy

APPENDIX B

Profiles

PERCEPTUAL TEST BATTERY
5 Year Old Profile

Name ____________________

Date ____________________

Age ______________

	AD	AM	AS	VD	VM	VOMT
	30	60	70	20	16	20
						19
+2	29	50	50	18	14	16
		32	27	15	11	14
	28	31	26	14	10	13
						12
+1	27	27	19	13	9	11
			17			10
	26	26	16	12		9
				11	8	
0	25	24	14			8
				10		
	24				7	
		22	10	9		7
	23	21	9	8		
-1	22	19				
				7		
	21		8			
		17			6	6
Adequacy	20					
Threshold	19	16	7	6		
	18	15	6	5	5	5
			5	4	4	4
	13					
		10		3	3	3
-2	12		4			
				2	2	2
	11	8	3			
	10	2	2	0	0	0
	9 Invalid					

AD scores below 10 invalidate the test. SAME score of less than 7 also invalidates test.

PERCEPTUAL TEST BATTERY

6 Year Old Profile

Name ____________________

Date __________________

Age _______________

	AD	AM	AS	VD	VM	VOMT
	30	60	70	20	16	20
+2		50	50	19	15	18
	29	35	29	17	12	15
	28	34	28	16		14
+1		30	24		11	
	27	28	19	15		13
	26	27	18	14	10	12
0	25	25	15		9	
	24	23	10	12		10
	23	22	9	11	8	9
-1	20	20	8	10		
Adequacy Threshold	21	16	7		7	8
	20	15	6	9	6	7
-2	10	2	2	0	0	0
	9 Invalid					

AD scores below 10 invalidates the test. SAME score of less than 7 also invalidates test.

PERCEPTUAL TEST BATTERY

7 Year Old Profile

Name ____________________

Date ____________________

Age ____________________

	AD	AM	AS	VD	VM	VOMT
	30	60	70	20	16	20
+2		50	55		15	
	29	43	40	19	14	17
		42	39			16
+1	28			18	13	
		32	29			15
	27	31	28	17	12	14
0				16	11	13
	26	24	20	15		
		23	19	14	10	12
-1	25					11
Adequacy Threshold		20	15	13	9	10
	24	19	14	12	8	9
-2						
	10	2	2	0	0	0

9 Invalid

AD scores below 10 invalidates the test. SAME score of less than 7 also invalidates test.

PERCEPTUAL TEST BATTERY

8 Year Old Profile

Name ____________________

Date ____________________

Age ____________________

	AD	AM	AS	VD	VM	VOMT	SOMT
	30	60	70	20	16	20	20
+2		48	41		15	19	14
		47	40				13
						18	
+1	29						
				19	14	17	
		37	31				12
		36	30	18	13	16	11
	28						
						15	
0	27	30	20	17	11	14	9
		29	19	16	10	13	
-1	26						8
Adequacy Threshold		24	15	14	9	12	
	25	23	14	13	8	11	7
-2							
	10	2	2	0	0	0	0
	9 Invalid						

AD scores below 10 invalidates the test. SAME score of less than 7 also invalidates test.